INTERNATIONAL PROJECTIONIST

JANUARY 1946

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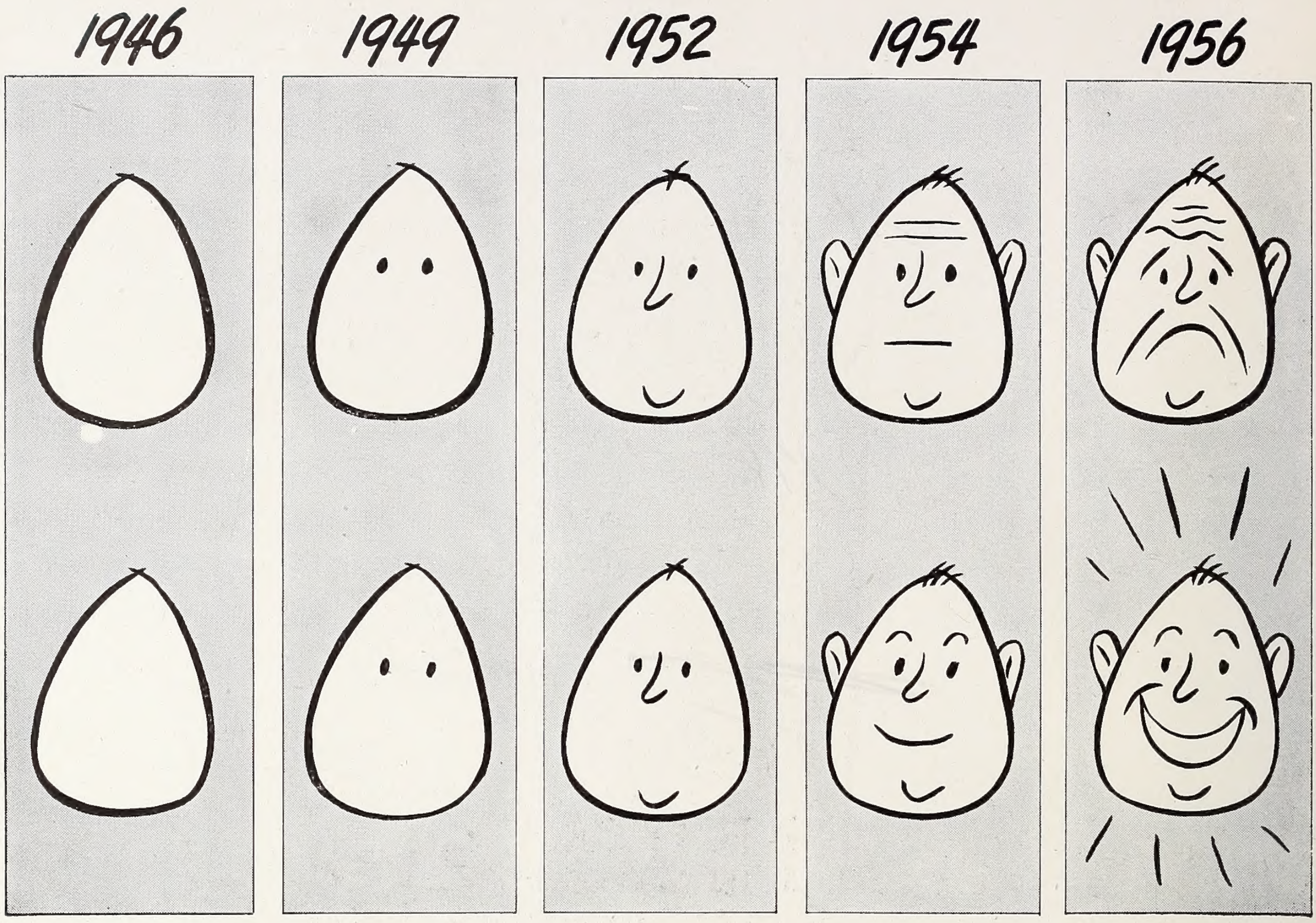

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It would be surprising if your face didn't show it.

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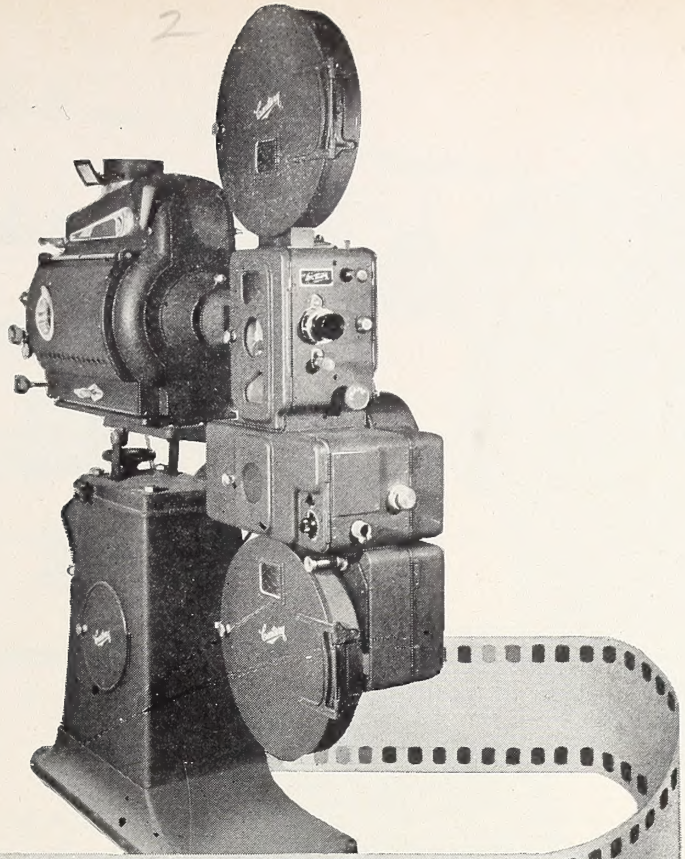

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INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

HENRY B. SELLWOOD — *Editor*

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MONTHLY CHAT

THE time has come to face squarely the facts anent television: the war is over, the bars are down, the lines are drawn. Any lingering doubts as to the imminency of commercial television (show business regarding a year as only a "season") were dispelled by RCA's recent demonstration of its television system, both color and black-and-white, and the unveiling of a line of video receivers. Details of this event appear elsewhere herein.

Impressive as was this showing technically, the real story, from our point of view, lies in the prompt and vigorous reaction the demonstration provoked among competing telecasters, notably CBS.

RCA concluded showing its color tele system, then promptly announced that the present mechanical set-up (requiring viewing analyzers) was obsolete; in fact, "no advancement on identical experiments . . . abandoned by the film industry . . . in 1911." All-electronic tele, the ideal, was five years in the future, opined RCA, thus the industry should proceed immediately on a black-and-white basis.

"No," cried CBS, which holds that color will be ready within two years, a short time for the industry to wait before ushering in tele full-blown, with technique and standards, especially anent sets, all wrapped up in one neat package. CBS hinted, none too subtly, that RCA's desire to shove off now reflected the latter's position as a leading manufacturer.

Now, anytime there is a sweetly tart exchange of opinion centering on the potential spoils of a commercial enterprise, one may be sure that the gold lies in not too distant hills. In other words, tele is en route—*but fast.* This fact, *and it is a fact,* prompts several questions by this corner:

The video crowd ascribe a major role in the tele art to the "Hollywood film producers"—but where does this leave the theatre field? Has any branch of the film industry so much as stretched a shoelace to find the answer to the preceding question? Are projectionists prepared to cope with television—*if necessary?*

We don't know the answers to the foregoing queries, nor do we know of anybody else, least of all in the film business, who does. But of one thing we are certain, and that is that from this moment on our previous burning interest in the video art, particularly as its commercial course becomes clear, will have turned into a all-consuming conflagration. The availability of 500,000 tele receivers by the end of 1946 may not constitute very edible food for thought, but it sure does open up broad vistas for contemplation.

We recommend an equal measure of inquisitiveness on the part of the projectionist craft.

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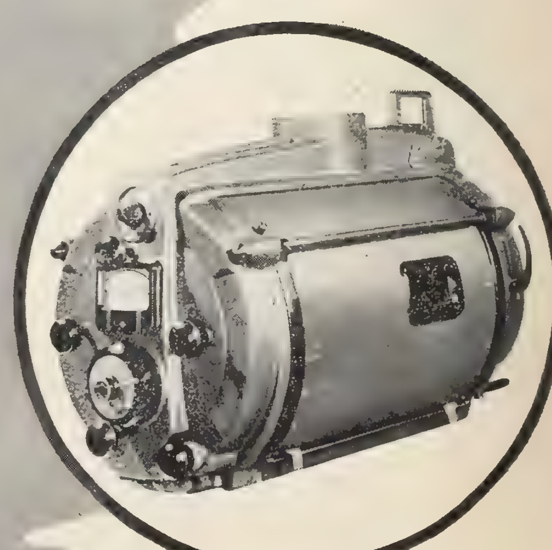

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"THERE'S A BRANCH NEAR YOU"

INTERNATIONAL PROJECTIONIST

VOLUME XXI JANUARY 1946 NUMBER 1

A Postwar 16-mm Projector: THE AMPRO PREMIER 10

By LEROY CHADBOURNE

Herewith another presentation by I.P. of data relative to outstanding equipments in the rapidly expanding 16 mm. field. Electrical and sound reproducing circuits of this popular equipment will be analyzed, by means of tracing through schematic drawings, in the next issue.

SALIENT features of the Ampro Premier 10 16 mm. projector are provisions which make it possible to lose and restore the loop while the picture is running; render it impossible for sprocket or claw teeth to scratch the film, even if the film be intentionally threaded across those teeth, and positive means for stopping the film at any time and then running it backward, or holding any frame on the screen in the manner of a still picture.

An overall view of this projector is shown in Fig. 1. It may be set up as shown on any convenient table, or on its own carrying case (see Fig. 4). The switches and controls shown on the sloping panel are, from left to right: tone control knob, projector lamp switch, volume control, motor switch, and microphone volume control knob. Just forward of the sloping panel, under a little rounded dwelling of the casing, is the projection lamp horizontal adjustment screw. The vertical adjustment screw is in the top of the casing behind the lamp housing, not visible in the picture.

At the bottom of the panel is a large, knurled bakelite knob which adjusts the tilt or projection angle. Just behind this are two switches: the upper one permits a choice of either sound or silent speed; the lower is used to make the motor run in reverse direction.

That section of the panel just above the switches can be removed, giving easy access to the governor brushes. Above this removable section is a smaller black knob, the clutch, the turning of which to maximum clockwise position makes possible the projection of single stills.

Threading the Projector

Film in the process of being threaded is shown in Fig. 2. The righthand forefinger of the projectionists rests on the gate lever which (in this most recent model) not only opens and closes the gate for threading but simultaneously and similarly controls the shoes of the upper and the lower sprockets. A two-finger loop is allowed between the upper sprocket and the gate.

The unit directly under the left-hand thumb in Fig. 2 is the pressure roller. This rides on the film during threading and maintains the lower loop until threading is completed, when the projectionist moves it to its forward position. Thus the lower loop is always exactly right.

Should the loop be lost, the lower end of the gate shoe (which, as subsequently described, is under exceptionally light tension) yields to the pressure of the film and allows it to assume a forward slope as it emerges from the lower end of the gate. Moving the pressure roller to the rear position temporarily (without stopping the projector) instantly restores the loop to sound synchronization.

Thus the film path is shortened, the film does not tear. A unique arrange-

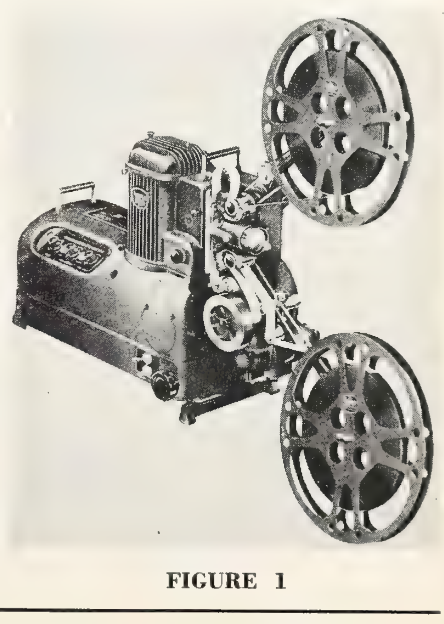

FIGURE 1

ment of the intermittent claw makes possible this extremely light gate tension. Fig. 3 shows the entire film path with threading completed and the end of the film about to be fastened in the lower reel.

Scanning of the sound track occurs at that part of the film path which is out of sight behind the flywheel in Fig. 3. The lens tube is vertical, with the exciting lamp below it, both lamp and lens being below the sound drum containing the p. e. cell. The sound drum is part of the flywheel assembly and is driven by the film.

The projection lens is focused by being pushed in or out, and for fine adjustment by being rotated, within the lens barrel.

Rewinding and Reversing

A view of the driving side, with film not threaded but being rewound, is shown in Fig. 4. To rewind, the belt-shifter (labelled 1 in Fig. 4) is rotated to its maximum counter-clockwise position. The reversing switch (the lower of the pair shown just behind the tilt knob in Fig. 1) is thrown to "reverse." The motor switch (between the two right-hand knobs on the sloping panel of Fig. 1) is then thrown to "start."

Rewinding may be accelerated by pushing button 2 (Fig. 4), just as the right-hand thumb is there shown. Thus there is eliminated the need to remove reels or belts, plus changing them around, in order to rewind. To reverse the film while still threaded, the pressure roller (directly under the left-hand thumb in Fig. 2) is moved to the rear position and the reversing switch is thrown to "reverse."

The control labelled 3 in Fig. 4 is the shutter adjusting knob; and, of course, 4 in the same figure is the upper reel.

The clutch knob may be seen in Fig. 1 above the left of the flywheel. To project a single frame this knob is rotated to its maximum clockwise position, and, if necessary, the projection lens is refocussed to sharpen the image. The film may then be advanced one frame at a time by rotating the shutter adjusting knob (No. 3 in Fig. 4).

Operational Details

After removal from the case, the projector may be set up on the lower part of the case to give it additional height above any table that may be used. The upper portion of the projector case carries lubricating oil, spare exciter lamp, a box of fuses, spare take-up belt, lamp glove for removing projection lamp, a small cleaning brush and spare lenses. The reel arms remain part of the projector *at all times:* they are merely unfolded into operating position. The spring belts rotate into the pulleys automatically. Reels and cables are carried in the speaker case.

The speaker is plugged into the projector assembly, *after* which the power supply is plugged in. This order of procedure eliminates any chance that the amplifier may possibly be switched on with no load across its output. The clutch knob (Fig. 1) is rotated to its maximum counter-clockwise position; then the motor and lamp switches are turned on. The lamp will not light if the motor switch is off, hence it can never light unless it is receiving the benefit of the cooling blower.

The light image is then centered on the screen by means of the tilt knob,

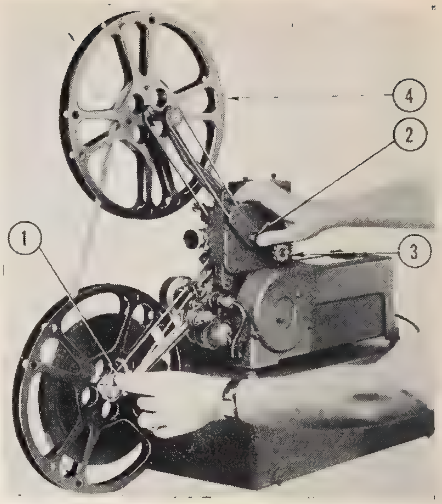

FIGURE 4

and by shifting the projector horizontally or by moving it toward or away from the screen, and then focussed. The volume control is adjusted as necessary till photocell hiss is heard, at which time the volume control should be at or very near maximum volume position. *If not, a screw-driver or even a finger nail is used to adjust p. e. cell voltage.* The adjusting screw for this is at the rear of the mechanism, on the same panel with the cable jacks and the fuse (not shown in these pictures).

For sound-film operation with 110-volts d. c. a converter must be used, although none is needed for silent operation.

Constructional Details

The projection lamp may be either the 750- or 1,000-watt type; it is vertically and laterally adjustable, as noted, without opening the casing. Film reels may be up to 2,000 feet capacity. The

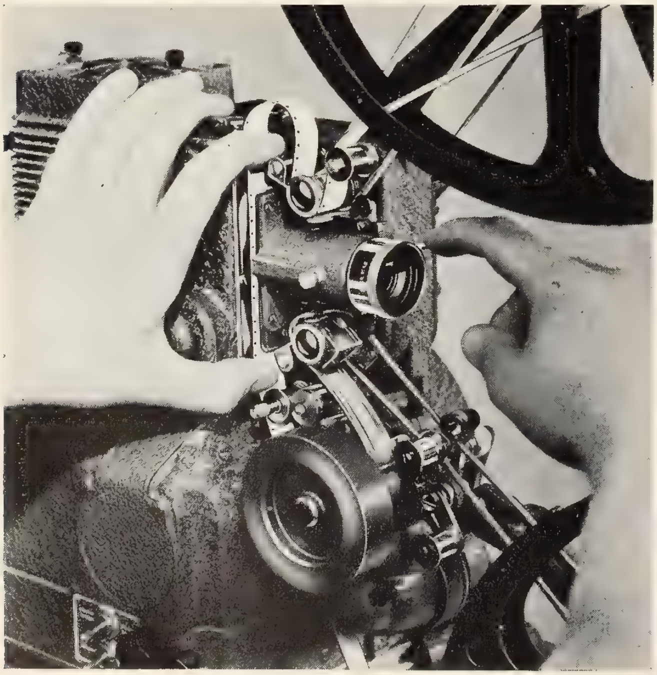

FIGURE 2

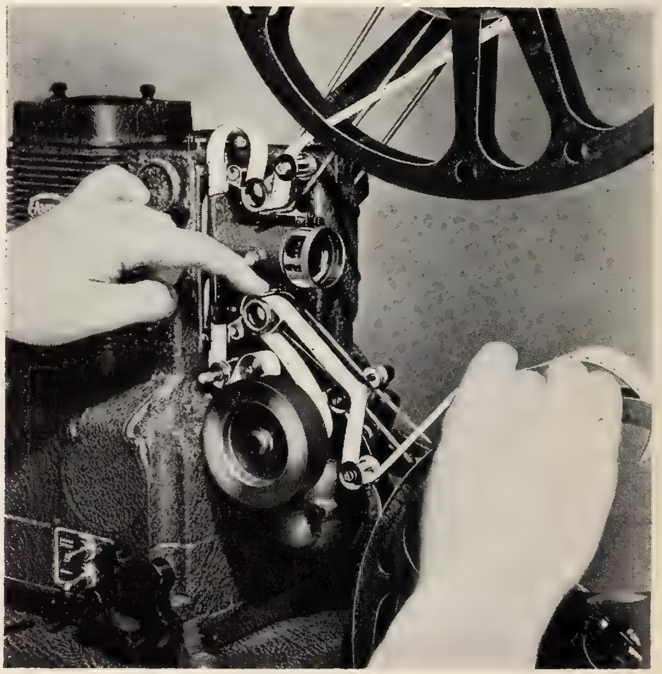

FIGURE 3

Eastman Films

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speaker case is equipped with removable front and back covers, both of which are removed for operation, at which time the speaker is protected by a separate grill.

The motor is a universal, series type, with automatic speed control for either silent (1,000 rpm) or sound speed (1,440 rpm). The ventilating system includes not only a blower which is effective in either direction but also an automatic deflector, operated by the air stream, which assumes different positions according to the direction of rotation of the blower and thus deflects the air stream into the identical path regardless of whether the motor is being operated in reverse or not. The general path of the air is: intake past amplifier and motor; exhaust past projection lamp.

Projection lenses are readily interchangeable: an *f*. 6, 2-inch focal length compound lens is normal equipment.

The sound drum is stabilized by means of a flywheel. Exciter lamp current is a. c. above audible frequency. The three-stage amplifier is transformer-coupled to the push-pull output stage, and includes a tone-control-inverse-feedback circuit. The speaker is a 12-inch permanent magnet cone with a rated frequency response of 100-5,000 cps.

Shuttle and Claw

The intermittent shuttle-and-claw provisions are unusual. Two vertical cams are used, although only one actuates the shuttle. The purpose of this arrangement is to assure dynamic balance in the shuttle action. The external surfaces of the shuttle, which might otherwise wear grooves in interacting parts, are turned over to produce wide, flat bearing surfaces that cannot groove anything. Eight holes, which have nothing to do with operation, have been drilled through the shuttle for the sole purpose of removing excess weight of material.

Two other features are the use of three instead of two claw teeth and a very faint trace of rotary motion on the part of the claw. The teeth, of course, move forward to engage the sprocket holes, move downward to pull the film down, retract, and then come up again, eventually to repeat the process. But there is an extremely slight rocking component in their downward motion, and the top tooth is slightly shorter than the other two.

By reason of this shortness of the top tooth, combined with the slightly circular motion incorporated in the downward action, only the two lower teeth engage the film at first; but near the end of the pull-down the faintly circular motion causes the top tooth to engage also. This top claw-tooth serves as a hold-back to check the momentum of the film. Because of this hold-back feature, gate tension can be adjusted more loosely than would otherwise be practicable, and the screen image still remains steady.

This light tension at the gate is responsible for the fact, mentioned previously, that the loop can be lost without tearing the film. If it should be lost, the pressure roller, seen directly under the thumb in Fig. 2, can be moved to rear position and then brought back, thus restoring the lower loop. Normal operation and sound synch. are thus restored while the picture is running.

Additionally, this loose tension assures that the claw teeth cannot scratch the film even when a misplaced patch or other difficulty allows them to strike the film instead of engaging the sprocket holes.

The upper and lower sprockets are of polished stainless steel, as are the gate and gate shoes. Sprocket idler tension is loose, thus the film will not be marred even should it ever ride up. If this should happen, the design of the sprocket which (as can be seen in Fig. 2) has a railway type flange outside the teeth, will ease the film back into position, and the light idler tension will enable the sprocket holes to re-engage.

None of these provisions compromises in the slightest degree the quality of the screen image, which is entirely steady. The manufacturers attribute this to the steadying action of the top, or hold-back tooth of the three-tooth claw.

Utmost Illumination Attained

The claw teeth do not engage the film every time they move down but only at each second downward motion. This double-cycle action permits faster shutter operation and the use of narrower shutter blades, with a consequent increase in screen illumination.

The projection shutter is of the rotary cylinder type which produces the dissolving effect of a double shutter, although consisting of only a single unit. This type of shutter is by no means uncommon, being well-known to many professional projectionists, but its application to the 16 mm. field is not without significance. This is usually referred to as a "barrel-type" shutter and is positioned horizontally between the lamp and the aperture.

There is also a safety shutter (concentrically mounted with the projection shutter), which drops automatically if the motor runs too slowly because of low line voltage or when the film is stopped by means of the clutch in order to show single stills. Stills are projected through an aperture in the safety shutter.

The motor is connected to the projector through a fabric belt, and spring belts drive the reels during projection and rewind; but the mechanism itself is completely gear-driven, both fibre and metal gears being employed in the unit.

The amplifier is mounted under the casing, behind the mechanism, with the tubes lined up along the driving side. They are protected by a tube guard grill. The bottom of the mechanism and casing are fully enclosed by a metal housing or plate which is held in position by six screws.

Maintenance Requirements

The Ampro Premier 10 has a single oil cup, located at the top left of the casing, through which the entire mechanism receives routine lubrication. When the projector is in constant use, three to five drops of oil should be added at this point every day. The same point should be lubricated once every thirty days when the projector is not in use.

Additionally, the spindle assemblies at the ends of the upper and lower reel arms should be lubricated with one or two drops of oil every three days; and the clutches at the ends of the reel arms with two drops of oil every week, as long as the mechanism is used steadily. No other lubrication is ever needed except at times of general overhauling.

The film path and projection lens should of course be cleaned daily or whenever the projector is returned to use. Reel belt tension also should be checked daily.

The projection lamp should be checked weekly for darkening or sagging of the filament. Two thumbscrews are removed, after which the top of the housing comes off and the lamp is lifted out with the help of the lamp glove, which is normally carried in the upper part of the projector carrying case.

Removing three cover screws gives access to the reflector-and-condenser assembly. This can be cleaned in place, or it can be taken out of the mechanism by removing two additional screws, after which the entire assembly comes apart and goes back together without any use of tools. The exciter lamp cover comes off by removing two thumb screws.

THREE NEW MEXICAN THEATRES TO HAVE RCA EQUIPMENT

Lorenzo Cué, René Becena and Manuel Espinoza, all of Mexico City, recently completed plans in New York for the building and equipping of three new de luxe motion picture theatres in Mexico City. Following conversations with the visitors while in New York, Karl Streuber, manager of the theatre and sound equipment department of the RCA International Division, stated that all three theatres will be furnished with RCA projection and sound equipment.

Sites for the three theatres, all first run houses to seat four to five thousand patrons each, already have been selected. Mr. Espinoza is managing director of the Operadora de Cines and owner of a large circuit of theatres in Mexico. Messrs. Cué and Becena are associated with him financially in the new project.

A RESEARCHER VIEWS TELEVISION†

By *E. W. ENGSTROM*

RESEARCH DIRECTOR, RCA LABORATORIES, PRINCETON, N. J.

PRIOR to the war, television had crossed the threshold leading out of the research laboratory. Television was then a practical reality with promise of becoming a significant factor in American life. As a result of the initial efforts to provide a regular program service, the participating public seemed anxious to see television service continue and expand. Television was ready—but the war intervened.

We are now at the stage where plans are being made effective for post-war services. Television is a new service of major importance and should receive favorable attention and consideration. Progress during the war has sharpened the tools used in television. We know better how to build electron tubes and circuits. We know better how to handle the radio frequencies used for television broadcasting. We are more sure of the techniques which will provide satisfactory pictures in the home.

To aid in visualizing the progress which has been made, let us review a few of the problems which were under consideration in the period immediately preceding Pearl Harbor.

Pre-War Viewing Sets

Pre-war television receivers provided an image which was viewed directly on the end of the Kinescope or cathode-ray tube, or, in some receivers, the tube image was reflected in a plane mirror for more convenient viewing. In all cases, however, the size of the tube imposed a practical limitation to the size of the picture that could be obtained. A typical home receiver employed a 12-inch Kinescope, which gave a fairly satisfactory picture size but made it necessary for the audience to sit quite close to the set if they wished to see all the picture detail.

As a result of the experience with these pre-war receivers, in the areas then provided with television program service, there was evident a need for larger images on the viewing screen in the home. Enlargement of the image in the direct-viewing type of tube was considered impractical for general application since it would require a tube of unusable proportions. Solution seemed possible through some means of providing an image by projection enlargement.

For a number of years before the war, active work had been in progress to develop a small tube giving a very bright picture which could be projected through a suitable lens system on to a large viewing screen. These projection Kinescopes were based on the same principles as the direct-viewing tubes, but employed higher voltages, delivering beams of much greater power to the fluorescent screen. The screens, of course, had to be processed in such a way as to be stable under these operating conditions.

By 1937 it was possible to demonstrate, on an 8 x 10-foot screen, a projected picture which could be viewed without undue fatigue in a well darkened room, although the picture brightness was not all that might be desired.

The next big step forward was the substitution, in place of the conventional lens, of an optical system adapted from that used by Schmidt for astronomical purposes. Essentially, this system consists of a spherical mirror which collects the light from the projection Kinescope, and passes it through an aspherical lens element on to a viewing screen. The aperture of the mirror is located at the center of curvature and the aspherical lens element is placed at the aperture to correct the aberrations of the system. Such an optical system makes possible many times more efficient utilization of the light from the Kinescope and brings projection television well into the realm of the practical.

One of the basic problems solved during the research on this optical system was that of economically manufacturing the aspherical correcting lenses. To grind these lenses was out of the question from a cost standpoint, because of their peculiar shape. A method was therefore evolved for molding them from one of the clear transparent plastics. This made the lenses a relatively inexpensive part of the projection optical system. Post-war television receivers having screens large enough to be viewed with ease in a living room of average size are thus made commercially possible.

At the transmitting end of the pre-war television system, program experience indicated definite interest on the part of viewers for seeing events as they happened. Often this called for using television cameras under conditions of relatively poor light conditions. Many events and happenings could not be televised because the usual light levels were too low. This called for major increases in the sensitivity of the Iconoscope or camera tube. Research on this had progressed to the point where substantial sensitivity gains were in sight when war called a halt to television work.

The progress made gives promise of a solution to this important phase of television broadcasting. The flexibility in programming which such an advance will permit is naturally of great importance. To be able to televise all scenes which may be seen directly will add immeasurably to the immediacy and spontaneity of television programs.

Compared to the broadcast receiver of sound only, the pre-war television set was an expensive item. In the first place it was really two receivers—one for sound broadcasting and one for television—and the television unit involved an expensive viewing tube. These factors were further aggravated by the original low quantity production. With the improvements that have been made in circuits and the design of circuit parts, and with mass production quantities, it is anticipated that post-war television receivers can retail at prices which will encourage rapid growth, resulting soon in a large television audience.

Network Television

If television and its auxiliary services are to expand rapidly, thereby providing a new American industry and a source of large-scale employment, we must have the means to carry programs from city to city over nationwide distributing networks. For years, forward-looking research and invention have been directed toward making it possible to provide

† Televiser, Summer, 1945, Edition.

these networks; the need to provide them is now upon us.

Two lines of approach have been followed—one through development of coaxial cables and repeater; the other through development of radio relays.

Early work in the field of television radio relaying led, in 1933, to the erection of a radio relay station at Arney's Mount in New Jersey. Using this relay point, television signals were successfully relayed from the Empire State Building in New York to Camden, New Jersey. As a result of these experiments, it was evident that television relaying should be carried out at higher frequencies.

By 1939, progressive developments of tubes and equipment permitted the establishment of an experimental ultra-high-frequency radio relay station at Hauppage, Long Island. This station was of the unattended type and was used for a number of experiments in relaying television signals between points on Long Island and New York City.

Research work was continued in this field until the advent of the war. As a result, it was possible to accumulate the necessary experience upon which to base the development of a post-war radio relay system for interconnecting television stations. Of course, a nation-wide network cannot spring up overnight, but must grow in orderly, logical fashion. This calls for planning in order to provide a logical and economical system of regional networks to interconnect groups of stations in the highly populated sections of the country, as well as connecting links to join these into a nation-wide system.

Preparations are now under way looking toward the establishment of such systems and it appears likely that the final networks will consist of a combination of radio relays and coaxial cable. In this way, pictures of events and programs can be flashed from distant points to be broadcast to audiences in many cities at once, after the fashion of sound broadcasting.

Theatre Television Prospects

With the development of the projection Kinescope and the highly efficient reflective optical system we have the basis for theatre television as a post-war service. For the first time in theatre history, means are available for bringing to audiences the thrills and drama of events as they occur at a distance in real life.

Shortly before the outbreak of the war, RCA Laboratories demonstrated a picture 20 feet wide. From experience gained with this equipment it will be possible to develop commercial theatre television apparatus.

The question of the future technical development of television is one of great interest to everyone concerned in any way with this new medium for disseminating entertainment and information. Continued developments and improvements in television are inevitable. Some of the principles required for these new developments are already known, some remain to be discovered. Further work on Kinescopes, particularly of the projection type, will make possible larger, brighter pictures.

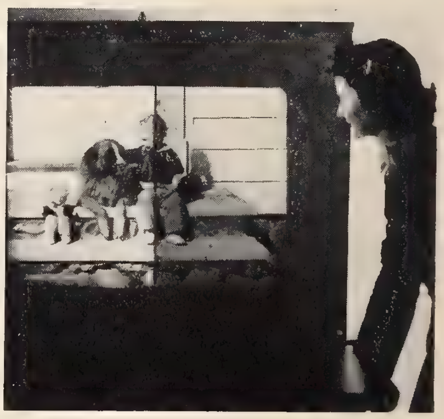
The continued investigation of circuit problems, of the requirements for picture definition and of most agreeable contrast relations will make it possible to improve greatly the quality of the picture within the limits of the present television transmission standards. All this will take time and effort but improvement is certain.

In the field of television network expansion, it seems logical to expect the transmission of vision to follow in the footsteps of sound broadcasting. Thus, after linking up the major cities in this country, the next step would be international radio relay stations to provide world-wide television service. While the techniques for this are not yet developed, it is logical to expect research to be productive along these lines when the need arises.

W. E. YEAR-END DIVIDEND

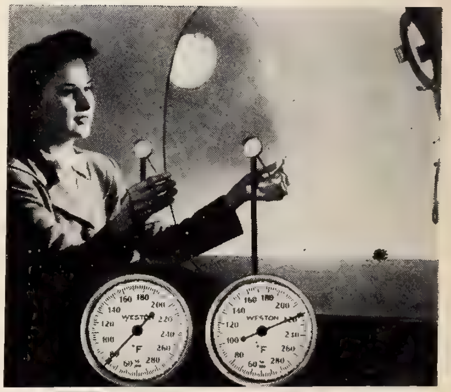
At a recent meeting of the directors of the Western Electric Company, a dividend of 50 cents per share on its common stock was declared. The dividend was payable on December 31, 1945 to stock of record at the close of business on December 26.

Sharp Heat Reduction, Better Color Rendition Claimed for New Glass



Improved projection of color pictures and cooler working conditions for motion picture and television actors are made possible by a new heat-absorbing, color-transmitting glass, according to a recent announcement made by the American Optical Company. This picture, a reproduction of a scene projected in color, demonstrates how the glass, when used as a heat screen in a projector, permits the projection of motion and still pictures in their original colors. Left half of the scene was projected through the new glass, and the right half through a previously developed, less efficient glass.

Dr. E. D. Tillyer, the company's research director, demonstrates how the new heat-absorbing, color-transmitting glass protects a film or slide against heat emitted by the light of a projector. Despite a protective shield of ordinary glass placed before it, the film in the right pedestal bursts into flames while the film in the left pedestal, protected by a piece of the new glass, survives without damage.



In addition to improving the projection of color pictures, this new glass can also be used as a heat screen in spotlights and floodlights to protect movie and television actors from scorching heat generated by the powerful lights. It is claimed that approximately 90 per cent of the present almost unendurable heat is absorbed by the glass. This picture demonstrates how the glass absorbs heat emitted by the floodlight (upper right). Thermometer placed before the glass registers 220 degrees F., whereas the temperature behind the heat-absorbing glass registers only 80 degrees F.

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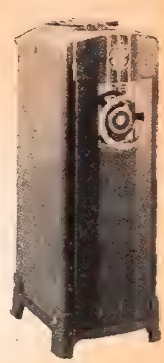

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TELECASTS

THE forward march of television was given strong impetus during the past month as the Radio Corp. of America and the Columbia Broadcasting System demonstrated their respective systems of black-and-white and color video. At the same time the controversy between these two titans of the broadcast world passed from the genteel stage of interminable and decorous publicity releases to a point where the contestants aired their differences in public.

CBS advocates a delay in introducing television until such time as it can be ushered in full-blown, so to speak, in one neatly wrapped package including color. This delay, says CBS, need not exceed a year, but the sale of home video sets at this time will result in obsolescence within a few years.

RCA, on the other hand, holds that an acceptable color television system will require at least five years, but since black-and-white video is now wholly acceptable, technically, it should be introduced promptly. As for the obsolescence angle stressed by CBS, RCA points out that this is the inevitable price of progress in any field, and adds that further delay on tele will tend to stagnate the art.

CBS adherents, although not its officials, hint that the RCA stand reflects the latter's extensive manufacturing interests, as contrasted with the CBS intention to farm out its manufacturing activities. Thus the opposing viewpoints.

Mechanical Color Systems

The RCA demonstration included not only color pictures in three dimensions but also vastly improved black-and-white showings. The three-dimensional effect is obtained, of course, by the use of special polarized filters in the camera and the receiver, and polarized glasses worn by the spectators, the latter being similar to the analyzers used for viewing the experimental three-dimensional movies made in the past.

The black-and-white images were transmitted *by radio* from New York City to Princeton, N. J., a distance of 47 miles; the color images were similarly transmitted over a distance of 2½ miles.

The CBS showing, also via radio, encompassed a distance of 12 N. Y. City blocks, from the Chrysler Tower to the CBS studios. RCA utilized "live" studio talent; while CBS employed film and slides.

Both RCA and CBS use practically the same means for producing color television, the three basic colors—red, green, and blue—being reproduced by mechanically revolving discs or cylinders. This reproducing means is frowned upon by RCA as unsuited for the home and as representing no advancement on identical experiments tried out and abandoned by the motion picture industry in 1911. The RCA goal is an all-electronic color tele system employing no moving parts. RCA lent emphasis to its stand by showing its color system and immediately terming it "obsolete."

RCA Receivers, Transmitters

It was generally agreed that RCA showed the best black-and-white tele images seen to date, on a screen measuring 4½ x 6 inches embodied in a table model direct-viewing set. Such sets, retailing from less than \$200 to \$300 will afford a screen size up to 6 x 8 inches. Sometime later in 1946 receivers featuring pictures 15 x 20 inches will be available for about \$500.

RCA will also manufacture tele transmitters for large and small broadcasters. A new camera employs the Image Orthicon tube, a wartime development, which is credited with "seeing" by candlelight and can pick up any event or scene discernible to the human eye. This makes possible round-the-clock programming, since light is no longer a problem.

A three-camera unit with associated radio transmitting apparatus for relaying remote or outdoor programs to the main transmitter now can be carried in a station-wagon, whereas earlier equipment was so bulky that two 10-ton trucks had to be used.

CBS was adjuged to have the best color rendition, but it follows that if and when all-electronic sets are available comparison on the basis of existing mechanical systems will be meaningless.

Network Television Plans

NBC plans envisage a new and improved transmitter atop the Empire State Building in N. Y. city and the building during 1946 of stations in Washington, D. C., Los Angeles, Cleveland and Chicago. Local networks will be meshed into a regional setup, and the latter will within several years develop a national network. Eventually coast-to-coast network television will be made possible by automatic relay stations, coaxial cable and stratovision (the system employing planes as described elsewhere in these pages).

Amid the welter of announcement and pronouncement anent the video art there exists a deep silence relative to programming, that is, what the purchaser of a television set may expect to see from day to day. Obviously, current events, especially sports which are expected to play an important role in television broadcasting, hardly can be expected to provide sufficient entertainment to sufficiently compensate the tele set buyer.

Great stress is laid upon the important role that films will play in television. One RCA official, when questioned as to the probable effect of television upon the motion picture industry, said that the "Hollywood studios" will be kept humming turning out film productions for television transmission.

Effect on Movie Theatre

Significant for those in the exhibition field, there is no mention made of what role, if any, will be played by the motion picture theatre. The strident voices that for many years proclaimed the importance of the "television theatre" now are strangely stilled. Nor does it seem that anybody in the motion picture business has stirred himself to ascertain the effect of television upon the film industry, even in terms of Hollywood production, much less in terms of the exhibition field.

Whatever the differences that exist between RCA and CBS on the technical nicities of the video art, it is obvious that both these parties, and all the others who are interested in furthering television, will shortly slip into high gear and buckle down to putting over this baby of the communication arts. Who pays how much for what and when must necessarily be of minor consequence to those thousands engaged in the motion picture exhibition field.

Once television sets start coming off the production line in any appreciable numbers, there would seem to be no lack of potential customers therefor, irrespective of the obsolescence angle. And once a few transmitters are in operation over an area important in terms of a consumer audience, support for television in the form of advertising dollars is inevitable. This fact, in itself, will force an answer to the question of programming—and the art may be expected to develop by leaps and bounds from there on.

Just where all this leaves the picture

(*Continued on page* 29)

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Common Projection Room Hazards

By *THEODORE P. HOVER*

Old yet ever new is the lesson to be learned from the accompanying article bearing on the many threats to the personal safety and well-being of the projectionist which may be regarded definitely as occupational hazards. Projection room safety precautions, it appears, are no less the concern of the Union than of the individual member, and the cooperation of both is required to establish and maintain proper standards therefor.

PROJECTION room fire is usually so spectacular and impressive to those involved in it, that it leaves a lasting impression. The result is that the beginner or apprentice has a definite ritual drummed into his consciousness, namely: cut off the light and turn off the motor; next to see that all port shutters have dropped or to grab a fire extinguisher, or, as frequently stated, to jump out of a window.

The only case within my knowledge of a projectionist attempting to carry out his boast that "When the fire starts, I'm on my way," occurred when the man in question was assigned to an unfamiliar theatre. A short-circuit in the distributing panel at one side of the projection room caused a blinding flash and explosion. The projectionist made for a window in the back wall of the room and was half through it when he discovered, to his horror, that he was about seventy feet above the pavement with no fire escape or ladder aavilable. (P.S.: He didn't jump.)

Due to constant vigilance by projectionists, film fires and injuries resulting from them are slowly being reduced. However, assistance from both theatre-owners and fire officials has been limited: projectionists are largely on their own. Major attention to the fire hazard has resulted in glossing over other important occupational dangers, classified as: (1) Mechanical (2) Electrical (3) Personal health and (4) Location and building.

Open gears, flywheels, and chains may easily come in contact with the hands or elbows of the projectionists, or more often, catch in their clothing. A short coat is emphatically much safer than the long smock which is frequently used. The idea that projectors are driven by a fractional horse-power motor and therefore constitute no particular hazard is a fallacy.

Heavy flywheels and the high inertia of the moving parts can remove a finger with the precision of a rotary saw, and the abominable practice of oiling projectors while they are in motion has added to the hazard. Neckties may catch in the moving parts, and care should be taken that handkerchiefs do not hang from the hip pocket and catch in gears or chains.

Some projectors have a very small clearance between sprockets and idler rollers when open. A finger carelessly placed on the moving film may be carried under the roller and badly mangled by the sprocket teeth. Sheet metal cones should be attached to the front of every lamphouse so that there will be absolutely no light leakage from cooling plate to lamphouse. It is a recognized fact that many of the older projectionists lost out due to eyestrain from this source.

Manufacturers have gone to considerable trouble to place grills and screens over the commutators and moving parts of motor generators, projector motors, exhaust fans and arc feed motors; but it is safe to say that less than ten percent of these guards are retained after the equipment is installed, usually being removed and lost. The practice of permitting ordinary electric fans to be placed in a projection room is exceedingly dangerous. The State of Ohio, for example, recommends that any such fan, regardless of positioning, should be covered on all sides with hardware cloth of a mesh small enough so that a handful of ⅝-inch ball bearings dropped on the guard will not fall through.

Careless or clumsy use of hand tools results in many serious injuries due largely to the fact that cuts and bruises become infected through lack of attention. One of the commonest accidents in projection rooms is caused by a screwdriver slipping and stabbing the projectionist. Almost as frequent are injuries caused by sharp slivers of steel being thrown from cold chisels or improperly used hammers. Snapping hacksaw blades can be extremely dangerous, as the parts may be thrown for a considerable distance. The only cure for this condition is a thorough knowledge of the proper use of hand tools.

The assumption that it is "only 110 volts" and therefore not dangerous is a first-class joke, cases being on record of death being caused by coming into contact with 70 volts a. c. It is often assumed that the power packs used in conjunction with amplifiers are not dangerous because, while they may deliver 200 or 300 volts, the amperage is low. The fallacy of this is proved by the electrocution of a Lima, Ohio, police radio operator who came in contact with the plate circuit of a small pre-amplifier. He was killed instantly, although the power supply was less than 250 volts.

Safety switches placed on amplifiers should not be strapped out, and, if defective, they should be replaced. Particular attention should be given to discharging high-voltage condenser banks before attempting to service an amplifier. A good condenser will retain a charge overnight or longer.

The personal health of the projectionist, as a result of his own negligence, usually receives less attention than even the most neglected piece of projection equipment. There can be no excuse for Union officials permitting a member to work in a projection room which is improperly ventilated (an 89-cent fan set in an open window does not constitute proper ventilation). I have heard many complaints by sound engineers regarding the accumulation of carbon dust and precipitated material from arc lamphouses in sufficient quantity inside the amplifiers to cause noise and, in some cases, completely cut off the sound. Some projection rooms have an accumulation of lamphouse deposit hanging from the ceiling above the lamp rivalling the stalactite formations of the Grand Caverns.

It is useless to go into detail regarding sanitary facilities in projection rooms, because projectionists themselves have permitted these matters to be neglected over a long term of years and will probably continue to neglect them in the future. The fact remains, however, that proper action can usually be secured if the Union does something about it. Public officials now are more receptive than ever before to such requests.

The careless placing of conduit and flexible conductors where they can be

tripped over can easily be avoided when equipment is installed. Floor coverings with snags or breaks are very dangerous and should be replaced or carefully cemented down. Grease or oil spots or carelessness in dropping carbon stubs can cause a bad spill which may result in broken bones. Bare concrete floors have been pointed out as a menace to the life of projector parts and film; however, the same dust is just as destructive to projectionist's lungs.

Some years ago it was customary to paint projection room floors with sodium silicate (water glass). This was fairly successful in giving a smooth finish to the floor and in preventing, for a considerable time, the dusting off of the cement surface. In damp weather, however, this material becomes a semiconductor of electricity, and there are possibilities of a violent shock if all equipment is not carefully grounded.

Examining film by rewinding it with the edges held between the thumb and forefinger is particularly dangerous. The exchanges maintain, and correctly, that this tends to crack sprocket holes and damage the film; but the real danger is the sharp edges of the film which will cut into the flesh like a razor blade, the dirt or dust on the film offering an excellent means of infection. A bottle of iodine and a number of bandages should be handy in every projection room. (Ed.'s Note: Mercurochrome, widely used as a "substitute" for iodine, is nothing of the sort, not having as much strength.)

Carelessness With Chemicals

Chemicals in common use in the projection room deserve some attention. Consistent exposure of any part of the body to lubricating grease and oils often results in serious irritation and may induce skin cancer. Many projectionists, in order to save their good clothes, keep at hand a pair of dirty oily trousers which they put on when making extensive repairs to their equipment. These oil-soaked clothes frequently result in painful sores due to the fact that certain skins are allergic to petroleum products. It is an established fact that ninety percent of the skin cancer epidemics which periodically break out in various industries are the direct result of the continued contact with dirty clothes saturated with oil or commercial solvents.

Many projectionists compound their own film cement, some of which is at once both wonderful and frightful. Frequently, glacial acetic acid is used. The fumes of this poison are violently irritating to the nasal passage and throat, and the projectionist who gets it on his fingers may carelessly rub his eyes, thereby occasioning a dangerous inflammation.

The most flagrant disregard of common sense and safety is the use of gasoline or naptha anywhere in a theatre. Few realize that the fumes of these solvents are heavier than air, will flow down ventilating shafts and settle close to the floor, remaining there for hours ready to explode at the slightest spark or open flame. This fact suggests an interesting experiment for you to try:

A piece of ordinary spouting or bent tin from six to ten feet long is laid from the edge of a table at an angle down to the floor. On the floor at the bottom of the trough place a lighted

(*Continued on page* 27)

Some Variations in Print Density

By *ARTHUR W. SWEET*

MEMBER, LOCAL NO. 528, KINGSTON, ONT., CANADA

Arthur W. Sweet

IT SEEMS to me that the recording on the prints that are coming through now, considered point by point, are definitely not up to the standards of three or four years ago. I am not referring so much to overall quality of prints, although this leaves something to be desired, as to the matter of sound level.

All projectionists have experienced no little difficulty due to variations in print density. I have witnessed density changes from one reel to the next which involve a change in fader setting of from one to three points. This trouble is particularly acute where one-man room operation prevails, with its manifold demands upon the projectionist's time and attention.

Hollywood makes great pretensions to attaining print uniformity; but we projectionists know from long experience that no such ideal state of affairs exists. Maybe the studio technicians are trying to overcome this difficulty by denying its existence and by "eliminating" the trouble verbally instead of tackling it head-on.

I have just finished running the Technicolor picture *Thunderhead*, by all accounts one of the better pictures upon which was lavished an ample budget and every possible production value. Pictorially beautiful this picture is, but the sound level was a glaring example of production shortcomings. So low was the dialogue in spots that I had to raise the fader level three steps, while at the same time other background noises, such as the whinnying of horses, was so loud as to completely blackout the dialogue.

Certainly the problems of film recording are many and varied, but maintaining proper sound level can be acomplished with a flip of the monitor's finger, irrespective of how wide are the variations.

Considering radio broadcasting as a basis for comparison: we all know that we can tune in a receiver on a station early in the evening and, despite the wide variety of programs, the volume level requires no attention after the initial setting. During a recent radio broadcast from our theatre's stage I observed very closely the work of the monitoring engineer. I had a radio set in the projection room upon which I picked up the program originating on our stage. A child singing on the stage below came through very clearly, and the applause from the theatre audience came through from the background in a very nice proportion—in other words, a true reflection of actual conditions in the theatre.

Background Music Level

Background music in films is another pet peeve of mine. Concededly a low musical background is desirable in dramatic presentations; but in action pictures does the use of background music enhance the effect of realism when used along with the sound of an onrushing train, fast-moving automobiles, etc.? I think not.

A sound engineer friend of mine recently stated that the picture studios used 50% modulation for speech and 100% modulation for music—so you can see where we projectionists would wind up if we set our sound level for speech alone.

It seems to me that this is one of the most vexing and pressing problems encountered by projectionists. There may be some angles to this problem with which I am not familiar, and to this end I should like to have the reactions of other men throughout the country, preferably through the pages of I. P. where everybody would benefit therefrom.

IN THE SPOTLIGHT

By

HARRY SHERMAN

MANY city officials in an attempt to curry favor with returning war veterans and with their eyes focused on the coming elections, are resorting to the old flag-waving, union-baiting tactics. They have suddenly emerged as champions of war veterans, demanding that unions open their membership books to all discharged war veterans, waive seniority laws, and push their old members around so as to make room for discharged veterans, regardless of their qualifications. Taking care of our war veterans is our duty and as we have stated, time and time again, means should be devised whereby these men will be able to follow their chosen professions. But, we think it ill behooves our worthy city fathers to point at labor unions and denounce them for their seeming unwillingness to open their membership rolls to all and any who may apply, when they themselves fail to give special consideration to the ex-servicemen who apply for licenses at the various city departments.

To illustrate a case in point, we refer to an item that appeared in the New York Times on December 1, 1945, *"Jobless Veteran Wonders Why He Fought; Quit Union Post, Now Denied Cab License."* A discharged war veteran who, because of injuries received overseas was unable to return to his old trade as sheet metal worker, applied for a license to operate a taxicab. The Police Department turned his application down because "permits are issued only to men who sold their cabs to enter the service." The same city officials who are so vociferous in their denunciations of labor unions are strangely silent in this and other similar cases.

Manpower Lift Would Help

Thad C. Barrows, president of Boston Local No. 182, in the September 1943 issue of I. P., hit the nail on the head in the following statements:

"Facts must be faced. We know that thousands of men have been trained as motion picture projectionists by the Army and Navy, and no small number of them will seek employment in our craft. I feel that it is our duty to take care of as many of these men as possible by admitting them to membership in I. A. In my opinion the first and most important step is the abolition of one-man operation in the projection room. This can be done if we agree to place in the projection room of every theatre now having a one-man shift a returned service man who will work together with the regular projectionist on the job. In doing so we will not only give the ex-soldier or ex-sailor a chance to rehabilitate himself but we also will assure the patrons of these theatres a greater measure of safety."

● Last month marked the 50th anniversary of the motion picture. Francis Doublier, honorary member of the 25-30 Club, showed the first motion pictures ever presented to the public in Paris in 1895, and several months later he went to Russia where he filmed the coronation of Czar Nicholas II. Today the filming of world events forms an integral part of our historical documentary files. Motion pictures play an important role in almost every aspect of our modern way of life—as a medium of entertainment and as a recognized factor in the world of education, science and industry.

A Revitalized I. A. Local

● We had occasion recently to check on the progress made by various I. A. local unions during the past few years and we were much impressed with the rapid strides made by one of our larger locals in regaining for its membership the prestige and goodwill it once enjoyed but later forfeited due to improper management. We refer, of course, to Chicago Local No. 110. The handicaps which faced the present administration when it first took over the management of the local's affairs in February, 1944, were many, and not a few of the practices inherited from former administrations presented pretty tough obstacles to overcome. Cracking tough nuts, however, is a dish much to the liking of Gene Atkinson, business manager of Local 110, and during his two years in office he has played a leading role in securing for the membership the many benefits they now enjoy—such as improved working conditions and salary increases, in addition to restoring to the local its former high standing in the community.

Gene Atkinson

For the benefit of our readers we will summarize briefly the benefits mentioned above.

1. For the first time in its history all theatres in the jurisdiction of Local No. 110 are 100% unionized.

2. Shortly after taking office in 1944, business manager Atkinson signed one-year contracts with Chicago exhibitors calling for salary increases, vacations with pay, and extra pay for preparatory time. These contracts were recently renewed on a three-year basis and call for additional increases totalling 10%.

3. Collected and paid back pay due members.

4. Organized special television classes which are attended by more than half the membership.

5. Contracts have been signed with major supply companies calling for the employment of Local 110 men in the installation and inspection of all motion picture and television equipment within a radius of 150 miles of local's jurisdiction. Contracts with National Theatre Supply Company and Motiograph, effective January 1, 1946, call for Local 110 man to inspect installations at $150 per week each man, plus expenses when outside of local's jurisdiction, and two week's vacation with pay.

6. Contracts for the showing of 16-mm pictures. Salaries of men operating 16-mm machines increased 33-1/3% in 1944, and an additional 10% in 1945—a total of 43-1/3%. Signed up race tracks for showing 16-mm film. Organized drive-in-theatres.

7. Unsanitary conditions in projection rooms corrected; adequate ventilation installed where necessary.

8. All returned service men placed in jobs. Veterans returned to positions held prior to service, or given choice of new ones.

9. The city of Chicago appropriated the sum of $13,416 for 1946 covering the salaries of two Local 110 projectionists employed by the police department. An additional $518 was appropriated for the vacation relief man for the two

aforementioned regular projectionists.

10. All business pertaining to Local 110 openly discussed at meetings. Open forum for all members; no secret deals behind closed doors.

Local 110 is credited with the sale of over $1,000,000 in war bonds, about 1/3 the total amount of bonds purchased by the entire I. A. The local was commended by Elmer Dowell, a representative of the U. S. Treasury Department for its splendid showings in the various bond drives. A donation of $10,000 to the Red Cross and the presentation of a fully equipped ambulance plane to the U. S. Army Air Forces are a few of the local's outstanding contributions to the war effort.

As an indication of the fine comeback the local has made under the Atkinson administration, Governor Green of Illinois appointed Gene a member of the Selective Service Appeal Board, representing labor. At the I. A. convention in 1944, President Walsh appointed him to meet A. F. of L. President William Green, upon his arrival at St. Louis and escort him to the I. A. convention hall where Green was scheduled to address the delegates.

As business manager of Local 110 for the past two years, we believe that Atkinson has demonstrated unmistakable qualities of leadership plus a keen sense of responsibility for the welfare of his members, in addition to the ability to protect their interests.

● Minneapolis Local No. 219 reports the signing of new contracts with 45 independent houses. Some of the features of the new contracts are a 4.2% wage increase retroactive to Dec. 1, 1944; pay for 15 minutes preparatory time, also retroactive to Dec. 1, 1944; one week's vacation with pay; an additional increase of 2½% for 1947, and another 2½% for 1948. On the Wage Scale Committee negotiating for the local were Wallace J. Yutzy, chairman; Claude J. Hubbard, Pat McMurchie, Drew Roddy, and Roy J. Arnston.

● Harry Oppenheimer, secretary of Newark Local No. 244, threw a party last month in honor of his son Burton, a radar expert for the U. S. Navy. Burton served on the Lexington and came home bedecked with ribbons showing 11 battle stars. Old man Oppenheimer's chest expanded near to bursting point every time he looked at the youngster. Can't say we blame him.

● We have received many requests from I. A. men throughout the country for information on seniority laws. We suggest to these men and to all others who may be interested in the subject to get in touch with Local No. 171, Pittsburgh, Penna., for data on its seniority law, which has been adopted by many other I. A. locals. Contact business agent Wm. H. Thompson for full particulars.

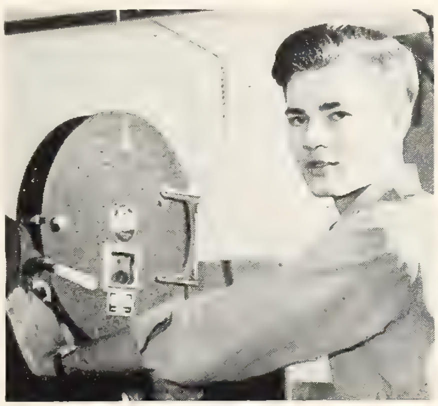
● Don Rood, secretary and business agent of Local No. 128, Utica, N. Y., and member of the Tenth District Executive Board, was elected Alderman in the last city elections. Don modestly refrained from mentioning this to us when we met him at the District meeting last month, but we got the information through our secret sources.

● A tip to California locals. The California Horse Racing Board recently recommended the filming of all horse races, and we have been reliably informed that arrangements have already been completed for the filming at five leading California race tracks. The motion pictures will be taken with the newer motorized cameras, and they will be ready for projection within seven minutes after a race is over. This will enable the stewards to see films of the entire running of a race before making decisions.

The showings of these films come under the jurisdiction of I. A. locals, and it is up to the business agents to see that I. A. men are placed on these jobs.

Notes from Local No. 279, Houston, Tex.

● Woodrow Wilson (not related to his famous namesake), member of Houston Local No. 279, is mighty proud of his offspring, young Bob, a junior student at Texas A & M College. Bob, who is 18



Robert Wilson

and well over 6 feet tall, is chief projectionist at Guion Hall at the college, and, like his father, is a member of the Local 279. Wilson, Sr., has been employed at the Horwitz Theatre for the past 26 years and has established a record for steady attendance on the job.

J. E. (Grandpa) Hogue is anxiously awaiting the discharge of S/Sgt. Wm. E. Hogue, a veteran of Guadalcanal and Tarawa. Sgt. Hogue enlisted with the U. S. Marines before the sneak attack on Pearl Harbor and was out of this country exactly five years when he returned November 7, 1945. He took part in some of the bitterest fighting in the Pacific and we will wager that he could tell many an interesting tale if he so felt inclined. At present he is stationed at Corpus Christi.

Other discharged service men from Local 279 include Lt. W. J. Perrittee, 15 months in the Pacific; Lt. L. F. Hall, 15 months flight instructor; Radio Tech. 2/c P. N. Ward, 18 months S. Pacific; J. Kramer, T/M 2/c, 17 months S. Pacific, and S/Sgt. G. C. Oakes, Jr., in service 33 months. Oakes, Jr., by the way, is a son of Pat Oakes, chief projectionist for the past 18 years at Loew's State Theatre.

Daniel Schulman, son of Nathan Schulman, one of the local's oldest members, took part in all the major battles fought in the South Pacific and came through unhurt. He returned to the United States several months ago and was seriously injured in an automobile accident returning home from a little pleasure trip to Galveston with several friends. We understand that he is now at the Navy Hospital at Camp Wallace and is out of danger. Fate certainly does play funny tricks upon us mortals—here is a boy who survived some of the bloodiest fighting of World War II only to get hurt when home on furlough.

● Charlie Vencill, secretary of Los Angeles Local No. 150 announces the addition of the following Local 150 members to the membership rolls of the American Legion Dawn Patrol Post No. 380; Joe C. Pierce, Leo Glenn, Clyde Shuey, Rudolph J. del Castilli, Joseph A. Jacoby, Curtis A. Kemper, George P. O'Brien, and Brinkley S. Richards.

● The Tenth District Annual meeting, held at the St. George Hotel in Brooklyn, N. Y., last month was attended by delegates from 45 I. A. local unions in this state, in addition to representatives from seven other states. At the opening session I. A. President Walsh spoke at length on the Hollywood strike situation giving the delegates present the inside story of its many ramifications. Several resolutions were passed, one calling for an official letter of sympathy to be sent to the widow of the late Glenn Humphrey, who was secretary of the Tenth District for many years; and one, introduced by Ed Batey of Poughkeepsie Local No. 199, recommending the adoption by the United Nations Organization of the Hyde Park home of our late president, Franklin D. Roosevelt, as its permanent headquarters.

The banquet, which followed the meet-

(*Continued on page* 34)

Projectionists' Course on Basic Radio and Television

By *M. BERINSKY, E.E.*
MEMBER OF INSTITUTE OF RADIO ENGINEERS

XIX—VACUUM TUBES (Continued)

THE DIODE type of vacuum tube which was described in the preceding article has one serious limitation in its application to radio circuits. The diode is incapable of acting as an amplifier of radio signals. If the tube were to contain a third electrode which could control large amounts of plate current with a small input voltage the tube would then be capable of amplifying radio signals.

The addition of a third electrode to control the plate current was made by DeForest in 1907 in a tube called the "audion." His patent, issued in that year, was to become as fundamental as that of the Fleming patent in the development of the vacuum tube. He placed a lattice, or grid as it is now called, between the filament and plate (see Figure 1a). This type of tube is called a triode because it contains three elements.

The grid usually is a winding of wire extending the length of the filament or cathode. The spaces between turns are relatively large so that electrons can pass with ease from cathode to plate, being practically unobstructed by the turns of wire. The purpose of the grid is to control the flow of electrons which form the plate current. Because the grid is much closer to the cathode than is the plate, it will have more control over the plate current. When a tube is used as an amplifier a small negative d. c. voltage usually is applied to the grid. Under this condition the grid does not draw appreciable current.

The d. c. voltage is known as grid bias. The number of electrons attracted to the plate depends on the combined effect of the plate voltage and the grid voltage. If the plate is made more positive it will be capable of attracting more electrons and the plate current will increase. This effect will continue until plate current saturation is reached. After the saturation point is reached, any further increase in the plate voltage will have little or no effect on the plate current.

When a triode is operated as an amplifier the positive plate voltage is fixed in value. The proper operating plate voltage differs with tubes and circuits. The values of plate voltage found in practice vary from less than 45 volts in portable receivers and hearing aids to several thousand volts in very powerful amplifiers and in transmitters.

Some triodes contain a directly heated cathode, or filament, as it is often called. The filament reaches operating temperature almost the instant that the filament voltage is applied. For this reason, such tubes do not require a "warm up" period, and a radio containing such tubes throughout would play as soon as the switch were turned on. The schematic diagram for such a tube is shown in Fig. 1b. These tubes will be found in straight d. c. receivers, portable battery operated receivers, and in hearing aids, and when they are operated from a source of a. c. curent they have a tendency to produce a hum in the output signal.

The Function of Control Grids

For a. c. operated filaments it is desirable to have a certain amount of isolation between the cathode and the 60-cycle house current which powers the receiver. For such receivers the triode is designed with an indirectly heated cathode. This is shown in schematic form in Fig. 1c.

When the plate potential is of a fixed value and the tube has reached a stable operating temperature, the grid is the only element that can influence the plate current. The grid bias, which is also a fixed value, will not cause the plate current to vary. It is used merely to determine the operating point on the grid volts versus plate curent curve. The grid bias must be of the proper magnitude, otherwise serious distortion may result in the amplified signal. In practice, an alternating voltage is superimposed on the fixed d. c. bias. The alternating voltage is the one which controls the plate curent in such a manner that amplification results.

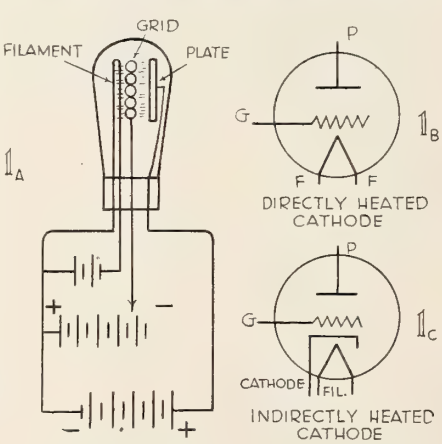


FIGURE 1. ***(a) Construction of triode tubes; (b) triode with directly heated cathode; (c) triode with an indirectly heated cathode.***

This alternating voltage can come from many sources in a radio, such as the incoming signal from a broadcasting transmitter, the output from an electric phonograph pick-up, the output from a microphone, or the output from a photocell in the soundhead of a motion picture projector.

When an alternating voltage is placed on the grid it will drive the grid alternately positive and negative. In practice this alternating voltage is made smaller than the grid bias so that the grid is never really driven positive, but becomes more or less negative depending upon the instantaneous charge placed on it by the alternating voltage. This type of operation applies only to radio receivers, the grid being allowed to go positive in large amplifying systems and in transmitter circuits.

When we speak of the grid as becoming less negative it means the same as if we were to say the grid is becoming more positive. Under these conditions the grid will not repel as many electrons as it would if it were more negative.

It must be remembered that the electron has a negative charge, and like charges repel while unlike charges attract. When the grid becomes less negative the plate current will increase because a greater number of electrons will reach the plate. When the alternating voltage on the grid swings through a negative alternation, some of the electrons which otherwise would reach the plate will be repelled back to the cathode by the increased negative charge

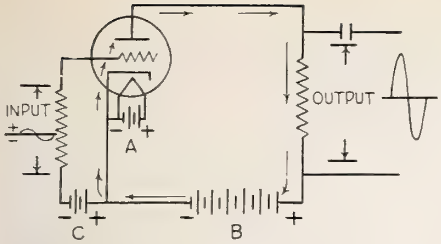


FIGURE 2. ***A simple amplifier circuit using a triode tube.***

on the grid. This will cause the plate current to decrease.

Hence, when the voltage on the grid is varied in accordance with a signal, the plate curent varies with the signal. It takes only a very small input signal to give a large variation in plate current. If the plate current is passed through a large resistor, the varying current will produce a large voltage across the resistor.

Assuming that the tube is operated properly, very little distortion will result and the voltage across the plate resistor will have the same characteristics as the alternating voltage on the grid. From this discussion it can be seen that a small voltage placed on the grid will result in a large voltage being produced across the plate resistor, and it is in this manner that the tube can amplify very small signals.

The invention of the triode tube made loudspeaker radio reception possible. A simple triode amplifier circuit is shown in Fig. 2. The grid is seen to connect to a "C" battery through a resistor. The "C" battery provides the negative bias for the grid. The cathode is tied to the positive side of the "C" battery, which means that the grid will be negative with respect to the cathode.

The signal is applied across the resistor in the grid circuit. This resistor is known as the grid input resistor and its value usually is about one meg-ohm or more. A large value of resistance is necessary here in order to keep the input signal from being shunted to ground.

If the resistor is made too large, distortion will result due to contact potential and large negative charges accumulating on the grid. The plate is connected to a large "B" battery through a resistor which is known as the plate load resistor. It can be seen that the positive end of the battery is nearest the plate and the negative end is connected to the cathode. This connection makes the plate positive with respect to the cathode. The plate must be positive with respect to the cathode in order for plate current to flow.

The plate load resistor should be large if much amplification is desired, the usual values being from 0.1 meg-ohms to 0.5 meg-ohms. The plate load resistor rarely exceeds 0.5 meg-ohms unless special circuits are used. The output voltage, which is the amplified signal, appears across the plate load resistor. From this point the output signal may be fed into a loudspeaker, or it may be fed into the grid of a second tube if additional amplification is required.

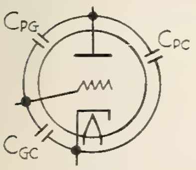


FIG. 3

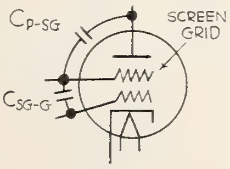


FIG. 4

FIGURE 3. ***(left) Interelectrode capacitances present in a triode tube.*** **FIGURE 4.** ***(right) Interelectrode capacitance is reduced in a tetrode tube by means of the screen grid.***

Inter-Electrode Capacitance

The grid, plate, and cathode of a triode form an electro-static system, each electrode acting as one plate of a small condenser. The capacitances are those existing between grid and plate, grid and cathode, plate and cathode, and are known as inter-electrode capacitances.

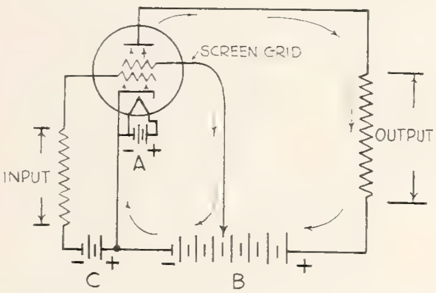


FIGURE 5. ***A simple amplifier circuit using a tetrode tube.***

As a general rule, the capacitance between grid and plate is of the most importance. In high-gain radio-frequency amplifier circuits, this capacitance can produce undesired coupling between the input and the output circuits. This coupling is undesirable in an amplifier because it results in unwanted oscillations, instability, and unsatisfactory performance. The inter-electrode capacitances which exist in a triode may be noted in Fig. 3.

If an additional electrode is placed between the grid and plate, the grid to plate capacitance can be reduced so that its effects on tube performance are negligible. This additional electrode which looks like the control grid, is called a screen grid, and it shields the control grid from the plate. It may be considered as tending to form two condensers between the grid and the plate. These condensers will be in series, so the total capacitance between control grid and plate will be reduced considerably. The screen grid acting in conjunction with a by-pass condenser which is connected externally between screen grid and cathode, will reduce the grid to plate capacitance from an average of 10 micromicrofarads for a triode to about 0.01 micromicrofarads, or less, for a tetrode. The method by which the capacitance between grid and plate is reduced is illustrated in Fig. 4.

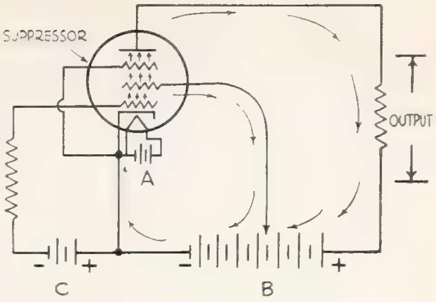


FIGURE 6. ***A simple amplifier circuit using a pentode tube.***

The screen grid is operated with a positive voltage, usually less than the plate voltage. The screen is closer to the cathode than the plate, and has a greater effect on the plate curent than is exerted by the plate. This makes the plate current somewhat independent of plate voltage and makes possible the design of tubes having higher amplification factors than is possible with triodes. The low inter-electrode capacitance makes it possible to obtain this high amplification without plate to grid feedback and resultant instability. In Fig. 5 we see the same amplifier circuit that is shown in Fig. 2, except that a screen grid tube, called a tetrode because it contains four elements, is now used in place of a triode.

In the tetrode type of vacuum tube the screen grid is placed between the control grid and plate. Although the voltage on the screen is usually less than that on the plate, it still is a fairly large positive charge. This positive voltage attracts the electrons strongly because of the magnitude of the voltage and the proximity of the screen to the cathode. The electrons, for the greater part, pass through the screen grid and move on to the plate because of the wide spaces between the wires which make the screen grid.

The electrons which move on to the

DECEMBER QUESTIONS AND ANSWERS

1. ***(Q.)*** **Which type of cathode gives the most emission for the least amount of filament power?**
   (A.) **Oxide-coated cathode.**
2. ***(Q.)*** **Which types of cathodes are best suited for tubes that are designed for portable receivers?**
   (A.) **Directly-heated cathodes.**

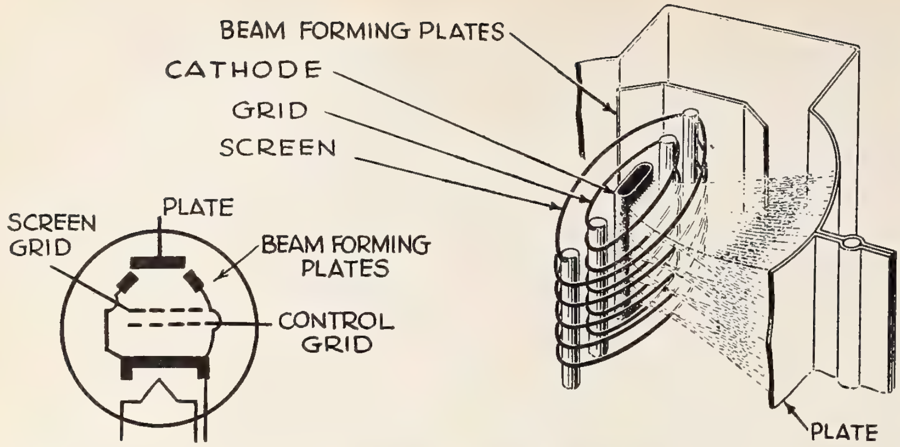


FIGURE 7A. ***(Right) Internal structure of a beam power tube.*** **FIGURE 7B.** ***(Left) Schematic of a beam power tube.***

plate are traveling at very great speeds. When they strike the plate, they will dislodge other electrons from it. This effect is known as secondary emission because the effect is secondary to the original cathode emission. Some secondary emission occurs in triodes but is of little importance because the only positive charge in the vicinity of the secondary emission electrons is the plate.

In a tetrode, the screen grid is in the path of the secondary emission and will attract some of these electrons. The secondary electrons in the vicinity of the plate will repel some of the original electrons away from the plate. These factors tend to limit the plate current and the plate voltage variations across the plate load resistor in tetrode tubes.

The plate current limitation is removed when a fifth electrode is placed within the tube between the screen and plate. This fifth electrode is known as the suppressor grid and is usually connected to the cathode. Because the potential on the suppressor is negative with respect to the plate, it will retard the flight of secondary electrons and will repel them back to the plate where they cannot cause trouble: This type of tube is called a pentode because it contains five elements.

The pentode is somewhat more efficient than the triode or tetrode, and because of its many desirable features, the pentode has, to a large degree, replaced the triode and the tetrode in amplifier applications. A schematic diagram of the basic amplifier circuit of Fig. 2, employing a pentode tube, is shown in Fig. 6.

Like a tetrode, a beam power tube contains four electrodes. Use is made of directed electron beams to give a highly concentrated electron current at the plate. This tends to increase the power-handling capability of the tube, As a rule, beam power tubes do not contain suppressor grids. Secondary emission is reduced by space charge effects between plate and screen grid. The screen is operated with a higher positive voltage than the plate. When the electrons move through the screen on their journey to the plate, they are slowed down because they move from a point of high positive voltage to a point of lower positive voltage.

Since the velocity of the electron stream is reduced, the secondary emission from the plate will also be reduced. In place of the space effect just described, it is also feasible to use an actual suppressor to repel the secondary electrons. The concentrated electron stream is produced by specially formed plates (Fig. 7a) which are connected to the cathode internally. A schematic drawing of a beam power tube is illustrated in Fig. 7b.

JANUARY QUESTIONS

1. **What is the function of the control grid?**
2. **What is the function of the screen grid?**
3. **What is the function of the suppressor grid?**

The answers to these questions will appear in the next issue.

Light and Electrons

In all matters relating to the projection room, the electron is considered to be a *particle* of electricity—a particle which has been weighed, measured and metered for its electrical force. Very accurate measurements have been made of this so-called particle, which indicate that its diameter is equal to 2.82×10^{-13} centimeters; that the mass or weight of the particle is 9.003×10^{-28} grams; and that the value of its electrical charge is 4.77×10^{-10} electrostatic units—all of which sounds very scientifically impressive, and would seem to indicate that if electron particles can be measured with such accuracy there can be no doubt at all that electrons are particles.

Which is very fine—but in the electron microscope electrons act as if they were not particles but waves! What is more, when the plate voltage inside the electron microscope is increased, causing the electrons to move at a higher rate of speed from the cathode or emitting source toward the anode, the wave-length appears to be shortened according to the increase in electron velocity.

With respect now to light, which in the projection room is considered always to consist of waves, having definite wave-lengths—violet light having the shortest wave-length and red light the longest—it can be proved by means of a device called an interferometer that light actually does consist of waves. By means of this device it is possible to add light to light in such a way that the waves will be 180° out of phase, whereupon light added to light produces darkness, exactly as ought to happen if light consists of wave motion.

But the common photocell is a device, among others, that simply cannot be explained on the assumption that light consists of waves. To explain the common photocell and other phenomena, it is unavoidably necessary to assume that light does not consist of waves but of particles—called photons.

Science, in other words, does not know the whole answers. It hopes to learn them some day.

So far as concerns projection optics—and such other applications of optical science as are used in designing microscopes, telescopes, cameras, and so on, visible light consists of waves which have been measured very accurately and found to have wave-lengths between 8,000 and 4,000 Angstrom units. This wave theory of light is perfectly "true" in the sense that it "works"—it permits engineers to produce very accurate results in the designing of lenses and related optical apparatus. But it does not in the least explain the action of photocells or other performances of light—with respect to which engineers are compelled to make use of the photon theory.

In the case of electrons, the particle theory is completely "true" so far as concerns the designing of entirely satisfactory sound equipment—but it is not "true" in other applications of electronics.

SIMPLEX PLANT TO NEW JERSEY; WORLD'S LARGEST OF TYPE

International Projector Corp., manufacturers of Simplex visual-sound projection equipment, will within a few months be housed in a new modern plant located in Boomfield, N. J., according to an announcement by Earle G. Hines, president of General Precision Equipment Co., parent organization. Negotiations now in progress with General Motors Co. will, when concluded, provide International with 150,000 square feet of manufacturing and office space, constituting the largest plant in the world for the manufacture of professional theatre projection equipment.

General Precision Equipment Co. has also announced the appointment as a member of its board of directors of Alfred Marshev, who is also president of Republic Aviation Corp.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

Flexible Insulating Tubing

A very good insulating "spaghetti" can be obtained from wartime solid house wire. A plastic insulation is used on this wire. Take a two- or three-foot piece of ♯14 wire, strip one end slightly, place the bare wire in a vise and pull the insulation off. It can be removed easily without breaking.—R. H. Bisbie, *RCA*.

Thrust Bearing for Film Magazines

A ball thrust bearing placed on upper and lower magazine shafts next to frame will act as a clutch for smoother operation of film coming off these reels. Place the bearing on the shaft after the spring has been removed, replace the spring, and tighten nut for proper tension.—G. E. Reiger, *RCA*.

Hint on Skinning "Mike" Cable

For skinning microphone cable when making up connectors and making connections, the work can be made much easier if done with a pair of pointed scissors.—M. P. Demming, *RCA*.

Card for Checking Optical Spot

By notching an ordinary calling card, as shown in Fig. 1, the card may be inserted into the end of the rotary stabilizer for observing the spot from

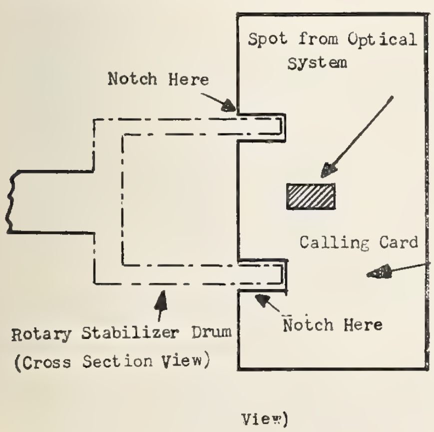


FIGURE 1

the soundhead optical system—without having to hold it in place by hand.—Charles Graham, *RCA*.

Volume Control Lubricant

For years I have been trying to find something that would keep contacts and volume controls quiet. I believe my quest is ended, for I have been using a product for a year now and it has worked perfectly in every instance. For example, it will keep a W. E. fader quiet between alternate monthly calls, while previously the unit would hardly operate a week without needing attention. Also, the product has completely eliminated noise in the wire-wound controls, on some of which it has been 7 or 8 months for a single application. It has also worked well in controlling noise in the Yaxley controls such as are used for changeover and volume control mechanisms.

The product is known as "No-Ox" and is made by the No-Ox Laboratories of Los Angeles and Chicago.—C. F. Craig, *RCA*.

Marker for Reel Cabinets

I have always used a China red pencil for marking film reel cabinets, to avoid errors in continuity, and it worked O. K. I believe I have found something better, namely, "Stick-O-Paint," which is available in red, white or yellow from the Lake Chemical Co., 6 East Lake St., Chicago.

This marker shows up very plainly, but it wipes off easily with a rag. Ask your local Police Dept. for a sample, as they use it for marking tires and windshields for overtime parking, etc.—Lester Van Buskirk, *L. U.* 744, *Alpena, Mich.*

Checking Large Capacitors in Power Supply Units

In power supply units a rapid check can be made on the capacitors by removing the capacitor fuses and turning the gain of the system up until the hum is quite prevalent. Replace the fuses one at a time and note the decrease in hum. If one capacitor seems inefficient, use a short jumper lead and cross it over to the choke connection on the opposite side, and by exchanging one capacitor with the other a comparison will result which will quickly locate the defective capacitor. Fuses may also be checked at the same time in the same manner.—C. R. Shepard, *RCA*.

Emergency Battery Charger

A 6-ampere Tungar rectifier bulb is connected in series with the battery to be charged, with a resistor also in series with the other elements. In Fig. 2, R is a 10-ohm, 200-watt resistor and can be

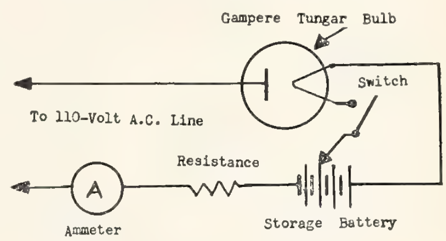


FIGURE 2

a heating appliance element. The ammeter is optional.

For the circuit to function, one cell of the three-cell storage battery is connected to the Tungar filament: after it has been brought to normal temperature the switch to this "heating" circuit is opened and the circuit is connected to the 110-volt a. c. line as shown. The filament will continue to glow even though there is no heating current supplied. The rate of charge with the values shown is around 5 amps.—P. D. Colson, *RCA*.

Tuning the 120-Cycle P. R. Filter

Here is a simple way to check on the tuning of the 120-cycle parallel resonant filter used in small RCA sets to suppress a. c. exciter lamp hum:

Open the external condenser connection and substitute a Cornell-Dubilier capacitor box (I have used the model CDB3, 01 to 1 mfd. in .01 steps to good advantage). When you arrive at the capacity for greatest attenuation, measured with an output meter and no film in the soundhead at maximum volume setting, replace with a capacity of the same value.—L. P. Work, *Jam Handy*.

The Stratovision System for Television, FM

By *C. E. NOBLES*

INDUSTRIAL ELECTRONICS DIV., WESTINGHOUSE ELECTRIC CORP.

PART II

THE Glenn L. Martin Co. studied the operation of an airplane of the type required for Stratovision operation. The airplane they have designed tentatively is for operation at 30,000 feet. Forty thousand foot operation seems feasible and is more desirable, but since we have at present more knowledge of the airplane design and operating costs at 30.000 feet, the Stratovision system is based on operation at the latter figure. In the future, higher altitudes may be possbile.

In the early stages of thinking about airplane operation of broadcast stations, it was felt that the operating costs for maintaining an airplane at high altitudes would be so great as to require that several transmitters be operated from one airplane, thereby realizing income from several paying advertisers. The operation of several transmitters seemed entirely feasible since the smaller-powered transmitters could be small in size and weight. At the same time many of the larger fixed and operating costs remain essentially constant whether the plane is broadcasting one or more than one program.

Operating Sequence

It was decided that the airplane design should be large enough to accomodate four television transmitters, five FM transmitters, monitoring equipment, and sufficient relaying equipment to carry four television programs and five FM programs, and also system communications channels. The airplane proposed is designed on this basis.

The sequence of events in the operation of one airplane transmitter is as follows: It is assumed here that the airplane is simply broadcasting and is not operating as a part of a program distribution network. The television and FM studios are located on the ground in the normal fashion. The program is fed into a small ground-to-plane link transmitters, picked up in the plane by a ground-link receiver, fed into the broadcast transmitter, and re-broadcast over the plane's line-of-sight area by means of the broadcast antenna.

If this plane were also functioning as part of a program distribution network, the signal from the ground-link receiver would also be fed into a small network-link transmitter and beamed to the next successive plane by means of a directional antenna.

For an airplane operating at 30,000 feet with one kilowatt of broadcast power, the metropolitan areas of many large cities are within the service range of this one airplane. A few such cities are: Pittsburgh; Baltimore; Washington; Charleston, W. Va.; Columbus; Toledo; Cleveland; Hamilton, Ontario; Detroit; Buffalo, and all of the smaller urban and rural districts inside this circle. This coverage represents a potential audience of 16,285,000 people.

One airplane, therefore, will deliver a service of four television programs and five FM programs to more than 16 million potential listeners. This one plane thus has the capacity to receive revenue from nine advertisers instead of one.

Operational Areas

Each plane has a broadcast service range of approximately 200 miles in every direction and relaying can be accomplished between two planes which are approximately 400 miles apart. By operating planes over New York, Pittsburgh, Chicago, Kansas City, western Nebraska, western Colorado, Salt Lake City and Los Angeles, a program distribution network from Hollywood to New York is established. These two cities are considered to be the main sources of television program material except for sports events and special events which might take place anywhere in the country. A very small amount of equipment in the plane will establish this link.

At the same time each of these planes broadcasts television and FM programs to an area of 103,000 square miles around its operating point.

By adding six more stations to this established network—these six flying over Durham, Atlanta, Memphis, Dallas, Sacramento, and Portland, Ore.—approximately 51% of the area and 78% of the population of the United States is brought within the primary coverage area of the 14 stations.

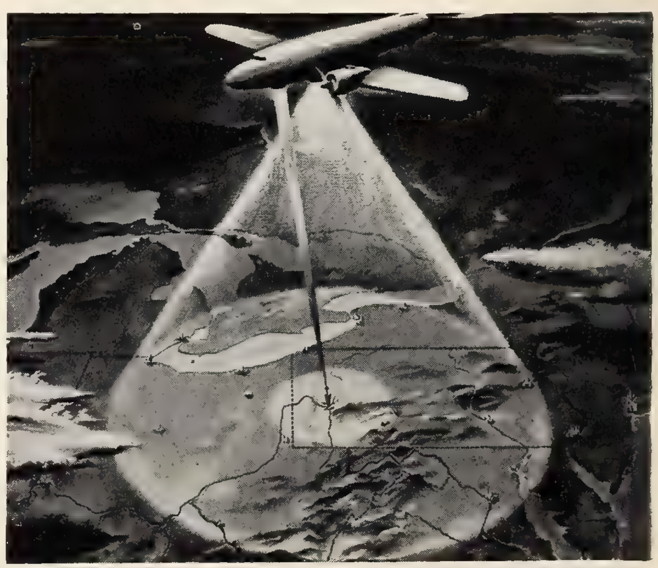
The fact that such national coverage is possible and that large program relaying distances may be used is very inviting from a viewpoint of obtaining program material. Almost any event in the country may be put on as a nationwide telecast with proper pickup facilities.

Variety of Program Material

Sports events, national elections, symphony concerts, Indian ceremonial dances, local disasters such as floods or hurricanes, and a great variety of other program material could be fed into the network quickly by a small "pickup" plane, equipped with television cameras and relaying equipment, stationed at each Stratovision base. Such a plane could fly quickly to the desired scene and relay the program back to the main relay link for broadcasting nationally.

This source of program material will not be so readily available to coaxial or ground-relay systems because of the relative inflexibility and small coverages of these systems.

Another advantage realizable from such large transmitter coverages and such an easily set up relay link lies in shortening the "build up" time for national television. Under present planning for television, the broadcaster and the listening public are at an economic dead-



Stratovision coverage would blanket an area 422 miles across, as indicated by the large circle in this sketch. Coverage by a ground-located station is limited to a 100-mile diameter, shown by smaller circle.

lock which will require a long time to overcome. There will be very few receivers sold in areas which are not served by at least one television program. On the other hand, broadcasters are generally wary about investing hundreds of thousands of dollars in television transmitting and studio equipment, etc., when there are no receivers in their service area.

The television broadcaster will necessarily take a long chance in investing large sums of money in transmitting equipment and expensive programs for long periods of time before he begins to realize a return on his investment. It will require many farsighted broadcasters and many years to build up a nationwide television service.

On the other hand, one farsighted broadcaster can immediately create programs for 16 million people by operating one broadcasting airplane. This should greatly advance the production and sale of television receivers and greatly reduce the time required to realize national television coverage.

Economic Comparisons

In attempting to evaluate economically the operation of airplanes for broadcasting, it is hard to find a concrete base for comparison. There is such a radical difference in the amount of television service obtainable by operating from airplanes as against operating ground stations that the two systems hardly have a common base. Many things can be readily accomplished by operating from airplanes which will never be accomplished by operating on the ground.

It was decided that the best method of economic presentation would be to compare the cost of operating one airplane against the cost of operating the number of ground stations required to give an equivalent coverage.

After comparing the two systems on this basis, a list of advantages and disadvantages which are hard to evaluate is used to supplement the foregoing comparison. Pittsburgh was chosen as a typical operating center, and by filling in the coverage from one airplane, it was found that eleven 50-kilowatt transmitters would be required to service the same area from the ground. Since one airplane serves the area with four television and five FM programs, an equivalent coverage requires 44 television transmitters and 55 FM transmitters, and approximately 33 relay stations.

In the cost comparison, it is assumed that the same program is fed into either system so that programming costs cancel each other.

The operating cost for one Stratovision station is estimated to be about $1,000 per hour. The cost for giving an equivalent ground coverage is about $13,000 per hour.

This cost comparison does not include the cost of relay stations or coaxial cable required to deliver the program to ground stations, but includes broadcasting costs only. If relaying costs were included, the ratio would be even greater. Additional advantages are:

1. Elimination of an expensive, inadequate, and slowly built up program distribution network.
2. The sale of television receivers should be greatly expedited.
3. The time required to build television into a nationwide service should be greatly reduced.
4. Many people in small urban and rural districts will have television who would never receive it otherwise because they live in districts which are too sparsely settled to support a station.
5. High-definition color television would immediately be placed on an equal footing technically with present black-and-white low-definition television.
6. The source of program material is greatly increased.
7. Many complicated antenna and "ghosting" problems can be eliminated because the plane is in continuous motion and all programs will come from one direction at any receiver.

Cause of "Ghosting"

These "ghosts" are out-of-register pictures superimposed on the desired picture. They are caused by a delayed signal, reflected from a hill or building, arriving at the receiver. They are very objectionable in some areas, such as New York. Because the transmitting airplane will be free of such reflecting objects, it is anticipated that "ghosting" troubles will be greatly reduced by the Stratovision system.

Since all programs will come from one source, the home receiving antenna can be made much simpler and at a lower cost. A fixed directional antenna can be used pointing constantly toward the airplane instead of a complicated motor-driven directional antenna to be rotated in succession toward the antenna of each new ground station from which a program is desired.

The fact that the airplane, and thereby the transmitter, is moving would also take advantage of an optical feature wherein the eye does not object to a moving "ghost" as badly as it objects to a stationary "ghost."

Radio equipment problems involved in Stratovision are very similar to those with which we have had considerable experience during the war. Almost every feature of the system has been proved by our experience of the last few years. The technical problems involved in putting this system into operation are capable of solution and are easier than those involved in the presently planned system. We feel that the economic problem is much more attractive and that it is the only system yet proposed which will make television available to millions of listeners in rural districts and small towns.

Plane Design Data

Aerodynamically, planes for the Stratovision system offer no particularly difficult problem. Every known flying aid—radar, navigational, and blind landing equipment—will be provided for in the basic design of the planes. Extreme wind velocities present a problem, but not an insuperable one. The absolute maximum velocity ever recorded was 181 miles an hour at 18,000 feet over Lansing, Michigan, in December, 1919.

B-29 crews over Japan often reported winds exceeding 150 miles per hour. The Stratovision plane with its cruising speed of 140 miles per hour and high speed of over 225 miles per hour will easily hold its own at 30,000 feet altitude against any wind encountered within continental U. S. limits.

It is no exaggeration to say that take-offs and landings will be accomplished in conditions of zero ground visibility. Indeed, the only condition in which a modern airplane cannot operate is when wind velocities on the airport introduce unwarranted landing and take-off hazards. It is doubtful if a ground transmitter tower will withstand the forces of a tornado, and as a matter of fact, in the 1938 New England hurricane, ground transmitters were off the air.

However, with Stratovision broadcasting, the rebroadcast airplane can take off from Chicago outside of the storm area, fly over Pittsburgh at an altitude safely above the weather and serve the area even when a hurricane may have disabled all ground equipment.

There are other things which can force the airplane down, such as loss of cabin supercharging pressure, but here again we will use the same technique which nullifies the effects of engine failure. We will supply 100% standby in all such items, including power generating equipment, emergency controls, oxygen and all the other items which make aircraft reliable in war and peace.

The airplane, as we conceived it, will require an operation crew of three, including pilot, co-pilot, and radar operator-navigator. The broadcasting equipment will be serviced by six operators. A comfortable lounge will be provided for relaxation.

Disregard of Safety Switches a Source of Danger to Projectionists

One urgently needed new habit, indispensable in dealing with television, should be formed by projectionists now before television equipment appears in the theatre. A large majority of projectionists appear to have a certain contempt for the dangers in handling live circuits. The practice of disregarding safety switches, with which careful manufacturers often equip sound apparatus, is widespread. As a matter of fact, some projectionists in their eagerness to handle hot circuits, jam these switches, nullifying the manufacturer's precaution.

These projectionists know very well that ordinary lighting voltage has killed many persons; that people have been killed repairing common household radios. But these things do not happen very often, therefore a complete disregard for the 300 to 900 volts that may be found in a sound amplifier has become increasingly common—and a great many men have developed a positive habit of disregarding electrical dangers.

That will be a sad habit to carry over into the days of television, when working potentials can be expected to run between 60,000 and 100,000 volts. Of course, such voltages will be surrounded by precautions built into the apparatus by the manufacturers, but the projectionists who today deliberately put out of action the safety switches of their present apparatus probably will carry over that tendency in dealing with the safety gadgets surrounding 100,000 volts. Especially when the show stops suddenly and a man rushes to his apparatus to do something about it quick, old-established habits will tend to carry over.

The time to form new habits is now.

Every projectionist knows that he should open switches and bleed condensers before working on electrical circuits. He also knows that he should form the habit of doing that *always*—even with circuits that are not very dangerous and even when his show has stopped. Every local union should foster the development of correct habits in handling electrical circuits among its own members—this should be done now before television hits the theatres.

INTEGRATED PLANT FACILITIES FOR MOTIOGRAPH EXPANSION

Motiograph, Inc., will be able early in 1946 to house all its manufacturing activities under one roof, on the basis of plans already drawn for an addition to the existing factory at 4431 West Lake Street, Chicago. Current manufacture is spread among three widely separated plants in Chicago. The new enlarged plant will contain a private theatre which will permit testing and demonstration of visual-sound equipment under actual theatre conditions.

Motiograph is now producing and delivering sound projection equipment at a rate far in excess of its previous peak year. The new plant will enable production to be trebled by mid-1946.

The Mirrophonic sound system line has been expanded to include models utilizing the postwar Voice of the Theatre loudspeaker system, and all ten models now include the 7500-type reproducers which are based on designs of Western Electric Co.

Distribution facilities for Motiograph products have been materially expanded by new dealerships in following territories: Kansas City, Denver, Cleveland, Philadelphia, Indianapolis, Minneapolis, Memphis, and New Orleans.

SIGNS ALTEC AGREEMENT

Altec Service Corporation announces that Elmer Rhoden's Fox Midwest Circuit of theatres has signed agreements with it to service the sound reproducing equipment in 59 theatres located in various cities and towns in Illinois, Iowa, Kansas and Missouri. The deal was negotiated by R. Hilton for Altec and Lew Pope for Midwest.

PROJECTION ROOM HAZARDS

(*Continued from page 17*)

candle. At the top of the spouting place a warmed teaspoon into which has been dropped five drops of gasoline or naptha. Use an eye dropper, not a gasoline can, as this demonstration is not a suggested means for suicide. In a few seconds the gasoline will have evaporated and suddenly a trail of flame will start at the candle and go up the entire length of the metal trough, showing that the gasoline fumes, being heavier than air, will travel downhill. Fire underwriters have records of entire homes being moved as far as 100 feet due to the use of gasoline as a cleaner for hardwood floors, the fumes traveling down through a hot air register and igniting at the furnace.

Many projectionists use carbon tetrachloride, carbona, or other non-inflammable solvents to wash projector parts. While this material is fireproof, attention is directed to the fact that the commercial product has many impurities, and continued inhalation of the fumes therefrom can cause serious injury to the heart and lungs. Like any other solvent, they should be used ONLY in a well ventilated room.

Another unwise practice is the storing of film cement in glass bottles, excepting possibly the small one or two-ounce bottles used with an applicator. There are several instances of these bottles being tightly corked and exploding due to the expansion of the solvent fumes of the cement. A tin can with a screw top is by far the safest item. If they should explode, they at least won't throw glass splinters around.

Port Shutter Hazards

Another source of injury is rather rare, but when it occurs the results are always unpleasant, namely, the dropping of port shutters on the projectionist's fingers. Many fire officials and theatre inspectors impose silly rulings that, regardless how efficient be the fuse system used on these shutters, they must be supported by a sashcord or other combustible cord. This is a nitwit idea. The abnormal heat in the projection room quickly rots cotton or hemp fibres, which have a habit of parting and dropping a port cover just as the projectionist has his hand on the port. Broken or badly lacerated fingers are usually the result.

The practice of installing port shutters weighing as much as fifty pounds and not counter balancing them is also to be condemned. Many such shutters are so heavy that if they were ever released by the fuse system, they would not only crash shut but their weight would tear the entire framework off the wall, and, possibly, the shutter might have to be retrieved possibly from the basement.

It is the writer's opinion that there is a separate section of Hell screened off for the persons originally responsible for the construction of a projection room door approximately 18 inches wide and 5 feet high. Such doors are an abomination.

The projectionist will find it necesary occasionally to go back stage to check horns or other associated equipment. Extreme care should be taken in working in what may be unfamiliar territory. Modern speaker assemblies weigh from 500 to 4000 pounds, and are easily overbalanced or tipped. The policy favored by a number of local unions of requiring that each member work one week in each theatre of the city in order to familiarize himself with the projection room and its equipment is to be highly recommended, for this practice permits familiarity with many diverse equipment set-ups.

A suitable container for carbon stubs is an absolute necessity, but, wherever possible, the proper place for it, despite the rulings of certain inspectors, is within the lamphouse itself; it should be emptied at least once each day, either before or after the day's run. Carrying the hot carbon stub outside the lamp to

a container constitutes an unnecessary hazard.

Almost every projection room has a certain number of constructional hazards, such as poorly lighted stairways, or refuse or material piled near the top of the steps, thereby providing a means for instant transportation to the bottom, usually resulting in broken bones. The writer tried this means of exit and cannot recommend it.

Large windows in the projection room, unprotected by bars or a fire escape, are a definite hazard, as it is entirely possible for a projectionist to be blinded by smoke or flame and fall through one of these open windows—but good!

Accidents do not "just happen." They are caused by doing something the wrong way. Only continued vigilance, thought, and study will reduce the rather high accident rate of the theatrical profession.

Many projectionists rely on accident insurance policies instead of on accident prevention programs, boasting that they have so much insurance that they are worth more dead than alive. Only that projectionist who has sufficient accident and life insurance the income from which will equal his present and future salary possibilities has the right to make this statement; and few of us have that right.

As a concluding thought, and for the benefit of both projectionists and theatre owners, experience qualifies me to make this remark: no projectionist can handle his equipment in a safe and satisfactory manner if his mind is occupied with the problem of how he is going to pay last week's bills with next week's salary; and the same holds true for the employee who may be wondering whether he is going to be compelled to go on strike in order to get his salary next Saturday night. Preoccupation with matters outside the theatre means a projectionist and an audience in danger within the theatre.

ALTEC ANNOUNCES AGREEMENTS

Renewals for Altec Service with Fox International Amusement Corporation for various theatres in Colorado, New Mexico, Utah and Montana are announced by Stanley Pariseau, Altec Los Angeles district manager, as well as for the Sunnymount Theatres, Inc., and Noya Theatres, Inc., for eight theatres in various California locations. Three new deals include the Pix, Pixley, Calif.; Meralta, Culver City, and Barbara, Los Angeles.

Henry Moog, Atlanta district manager, announces new service deals with the Lionel Delacroix Theatres of Plaquemine, La.; Lorine, High Point, N. C., and the Miriam, Pleasant Hill, La.

Bert Sanford, New York district manager, announces new service deals for the Strand, Marcellus, N. Y.; Millerton, Millerton, N. Y.; Arrow, New York City, and Earl Zimmers Theatre at Weedsport, N. Y. Also renewals with Keller & Blakely Theatres in New York and Pennsylvania. Bayne-Roland Theatres have renewed with Altec for their theatres in Virginia Beach, Va., and the Rialto, Canton, Pa., according to D. A. Peterson, Philadelphia district manager.

ELECTRICAL DESEARCH DIVISION IN NEW QUARTERS

Electrical Research Products Division of Western Electric Company has moved its merchandising and warehousing organization, its studio contact service group and engineering laboratory from 111 Eighth Avenue to the Photographic Arts Building at 245 W. 55th St., N. Y. City. D. C. Collins, division manager, announced. The movie was made to provide more adequate facilities and to locate the studio contact group nearer to licensee companies in the sound recording field.

"WESTREX" NAME MADE OFFICIAL

Stockholders of Western Electric Export Corp. approved changing the Company's name to Westrex Corp., according to an announcement by T. K. Stevenson, president. The new designation, a contraction of the name Western Electric Export, was authorized to conform to the company's already well established trade mark, Westrex, which appears on the company's own equipment.

TELECASTS

(Continued from page 14)

business is a moot question, however obvious it is that entertainment-seekers can hardly be expected to stretch a shoelace en route to the corner movie theatre if they can view and hear the same thing in the comparative comfort of their homes.

But one thing is certain: from Hollywood to the owner of the Star Theatre in Podunk, Maine, nobody in the picture business has bothered to so much as write a letter to a trade paper editor anent this matter of such great significance to the future of the industry.

* * *

The new FCC allocation plan provides for a total of 405 television stations in he U. S., of which 388 would use metropolitan channels, and the others would use community channels. New York, Chicago and Los Angeles are given 7 channels each; 33 other cities have been assigned additional channels; and community channels have been eliminated for 24 cities which are provided with at least one metropolitan facility apiece.

The FCC still is restricting multiple ownership to one station in any area, and is limiting networks to five stations. Television licensees will be required to share use of antenna sites where other sites are not available.

* * *

Little news issues from England anent television progress, but it is a safe bet that the acutely trade-conscious Britishers will not be outstripped by American advances in the art. British manufacturers are concentrating on moderately priced sets, since the home market appears satisfied with smaller home receiver screens than do Americans.

* * *

Coverage of the Army-Navy football game at Philadelphia was achieved by the use of three tele cameras, including the new image Orthicon (RCA). The event was piped to New York over the Bell System's new coaxial cable. NBC began regular tele coverage of Madison Square Garden (N.Y.) sports events on Dec. 9, with hockey on Sundays and basketball on Wednesdays and Saturdays.

* * *

Farnsworth has developed a tele receiving antenna that can be rotated and can shorten or lengthen its dipole arms, all by remote control, to obtain the strongest signal and to eliminate "ghosts."

* * *

Jurisdictional labor disputes, at present but a haze on the television horizon, are expected to build up to storm-cloud proportions early in 1946. Involved are broadcast engineers, technicians, stage and motion picture workers, electricians, painters, costumers, designers and directors — representing varied labor groups. The storm is expected to break first on the West Coast because of the location there of all the large motion picture studios. None of the crafts involved has made any overtures as yet to negotiate a prior settlement of this serious threat to the rapid and peaceful expansion of the art.

Presenting: Joe Moran

FORTY-THREE years ago an I. A. charter was issued to London, Ont., Canada, Local 105, and one of the names on that aging document is Joseph Maiorana. That fact in itself is sufficient justification, if any be needed, for spotlighting in this section one of that hardy band of pioneers who, ministering to the animate characters of show business, made it possible for thousands of others to earn their daily bread in a dream world of light and shadow. Yes (and we need not whisper it) this little yarn concerns a stagehand.

The Joseph Maiorana of 1903 has now undergone a metamorphosis, as a bit of typical show business alchemy, into Joe Moran, and it is as such that he is known to troupers and technicians from coast to coast.

Joe entered "the theatre" when he was 14 years old—surreptitiously, we suppose, in the manner of that time—and in the intervening 48 years he has stayed true to the "legit" and the I. A. except for one teeny, weeny AWOL period. The nature of this heresy? You'll never guess, so we'll tell you: he was Guy Lombardo's first trap drummer when that stellar band was in the making back in London, Ont.[1]

Wilton Lackey, Bessie Abbott, the Grand Opera Co., Comstock & Guest's Big Musical Show, Leave It to Jane, and Annie Russell are just so many names to today's theatregoers, but to Joe Moran they were very much alive, they *were* show business. These and many more engaged Joe's attention down through the years when he worked for Keith, Bennett, and Loew—with the latter being his employer for 26 years right down to today. Address: Loew's Theatre, London, Ont., Canada.

The "road" is no picnic at anytime, even in the present day of streamliners and what have you. In Joe's day it was what might be inadequately termed "rugged." True, trains did have wheels and did run on tracks, but they constituted just about the only mechanical motive power extant. And those hauls from station to theatre, and back, plus the absence of the many aids to modern stagecraft, made a propertyman's life an awesome career.

Joe recalls as his most difficult trek the shows that took him to the West Coast, via New York, three times within two seasons—a circuit that is a bit harder than hay even today. But it was all in the game, says Joe, and the rigors of the times were amply compensated for by a "bunch of grand people" on and off the stage.

"Show people were somehow a different breed of cat back in the days when vaudeville was flourishing," reminisces Joe as he contemplates the barren stretch of stage now occupied only by a white sheet backed up by a series a mechanical gadgets called "horns."

"Somehow or other show business was a career for show people in those days, and they went to it with a vigor that was spontaneous and infectious. Today it shapes up strictly as a business, with performers doing their stint 3,000 miles away before no audience save the technicians and the cold eye of the camera. Sure, the movies provide swell entertainment for millions of people, and they've contributed a lot to the common good outside that natural function; but I just can't become wholly reconciled to the substitution of a piece of celluloid for the 'real' thing.

"It all comes under the heading of progress, I guess; and maybe the spread of television will induce the same nostalgia in the present film technicians. I suppose trouping is trouping whatever the medium employed."

Yeah, Joe, we guess it is, and however you feel about it today, nobody can pry apart from you today, at 62, the treasure chest of glorious memories that were laid away during 48 years of service to the greatest business of them all—show business.

([1] P.S.: Stricken from Joe's AWOL record was reference to an interlude during which he was a picture songster for silent films—admission 5c. The "film" angle is what saved him.—Ed.).

NEW WESTINGHOUSE BOOKLET ON PROJECTION LAMPS

Westinghouse Electric Corporation has brought out a new booklet which describes a complete line of photographic and projection lamps. The booklet is illustrated and gives practical application information concerning photoflash, photoflood, color photography motion picture production, spotlight, fluorescent, photographic enlarger, projection and sound reproducer lamps. Specification tables are shown for quick selection covering rating, bulb shape and diameter, burning position, temperature, lumens and other data, as well as list prices and ordering numbers. Copies of the booklet (A-4754) may be secured from the company's lamp division, Bloomfield, N. J.

LETTERS TO THE EDITOR

PROJECTION IN PALESTINE

To the Editor of I. P.:

On the chance that projectionists in the U. S. may be interested in cinema goings-on in foreign countries, I am appending the following facts relative to Palestine. Many people consider Palestine as old-fashioned, a typical Near East country; but I can tell you that it has very high standards in every respect, and that goes for movies, too.

I am a relief projectionist and a member of a Local Union of the Federation of Jewish Labor. In the three major cities of this country—Tel-Aviv, Jerusalem, and Haifa—two projectionists are employed at all times, and in the large theatre there are three projectionists, one of whom is the "chief." Second-run houses utilize only one projector, with one projectionist.

In the major cities pictures are changed weekly, and a really popular release runs two or more weeks. The film exchanges are located in Tel-Aviv which, with a pure Jewish population of 175,000, has nine first-run and four second-run houses. First-run houses average 1,000 seats, with one open-air project seating 2,000.

Jerusalem, with a mixed population of 161,000 has only four first-run and four second-run houses; while Haifa, with 129,000 people has three first-run and one second-run theatres. Jaffa has a pure Arabic population of 62,000 served by three theatres. Small towns and rural communities have one or two theatres.

German Equipment Predominant

Equipment here is varied, although the German Zeiss-Ikon Ernemann projector predominates—more than 70%, in fact. In Tel-Aviv, for instance, nine theatres use Ernemann's; others use B.T.H. and Kalee (British); Bauer and A.E.G. (German); Philips (Dutch), and Gaumont (French).

In Jerusalem and in Haifa some theatres use the Simplex E-7, while other localities use the DeVry and other portable models.

Concerning the German projectors, for which parts could not be obtained during the past six years, projectionists here have worked miracles. Ernemann projectors 25 years old still are running satisfactorily. Ernemann V's, which have been running 7 hours daily for 14 years without any part replacements, still are in very good condition; in fact, the picture still is rock-steady.

An outstanding case is that of an Ernemann which has been running for 21 years, 9 hours daily, as a single projector in a small house: a breakdown recently necessitated replacement of two gears and the mechanism is again in very good working condition.

The Ernemann I is very crude, with all its gears showing, front shutter and vertical framing. With the Ernemann II, each mechanism has hermetically sealed-in gears, automatic oiling, central framing, and an air-cooled gate. This model has a front shutter. The Ernemann V has in addition to the foregoing water-cooled oil and gate, with a rear "barrel-type" shutter, like the Motiograph, incorporating a centrifugal automatic fire shutter. High intensity light may be employed with this projector and still the gate is cooler than a human body (damn those Jerries!)

The Ernemann VII B incorporates a soundhead, and it also has an electric picture-and-sound changeover. This mechanism is similar to the Weber Syncrofilm announced by Weber Machine Co. in the U. S., which I read about in I. P.

Sound systems used here are mostly RCA, W. E., and Klangfilm (German), with the latter being a bear for ruggedness and work but not so good on quality. Considered the best all-around projection

is that in the Allenby Theatre, Tel-Aviv, which uses the RCA PG 139 system, Ernemann V projectors, and Strong H. I. arc lamps.

Prints with Hebrew sub-titles are not available, thus Hebrew translations are projected on a separate screen which is one-quarter as wide and the same length as the picture screen. This is accomplished by using a 500-watt incandescent lamp and a lens of four times the focal length of the regular projection lens. The translation is written on blank film and is projected by a continuous movement.

Technical literature and any comment on projection matters will be welcome not only by myself but by all projectionists here.

ARIE UNGER
Tel-Aviv, Palestine.
77 Dizengoff Road.

MORE ANENT V-TYPE BELTS

TO THE EDITOR OF I. P.:

I noticed Corporal G. A. Wagner's letter about the use of V-type belts for take-up assembly drives (p. 24, Oct. 1945). The Corporal and other projectionists may be interested to know that I have been using this type of belt for more than a year now—and with excellent results. Having had no trouble since installing these belts, I am convinced that they can be used on any modern projector without any mechanical changes being necessary.

I use Motiograph projectors, with their grease-lubricated take-up clutch, and RCA soundheads. Ours is a continuous show policy, averaging 11½ hours daily, so you see that the belts really take a beating.

The only possible difficulty is that of installation, and the trouble involved is a small price to pay for the excellent results obtained. On most projector heads it will be necessary to remove at least one gear in order to insert the belt. After replacing the gear, everything goes along normally.

I use the Gates Truflex #2400 belt sold in almost all automobile supply stores at $1. This #2400 size just fits my equipment. When purchasing these belts, get one 2½" longer in inside circumference than the round leather belting, as it does not seat securely in the round belt pulley and allowance must be made for that in order to avoid a very tight belt. Although these belts are not represented to be oil-resistant, they are standing up very well and show little sign of wear.

I estimate I will get at least another year's wear from these belts, thus they average about two years service.

HERBERT SCHWARTZ
Bronx 66, N. Y.

Watching Atoms Die

Radium is one of several unusual chemical elements whose atoms go to pieces of their own accord—a process called radioactivity. When a radioactive atom breaks up, energy may be given off in the form of penetrating waves, or the energy may be expended by means of super-fast particles of electrified atom fragments.

The paint on a luminous watch dial contains a tiny amount of a radium compound. As the radium atoms break up, they jolt the molecules of the paint, causing them to give off the familiar greenish glow that is visible in the dark. Using a lens or magnifying glass of short focus, you can observe the death-throes of the radium atoms.

First rest your eyes and thus make them more sensitive by remaining in a perfectly dark room for five minutes or more. Then examine the watch dial with the magnifier. In place of the soft, uniform glow seen with the unaided eye, you now see pin-point flashes of light—scores of them at one time. What you observe are the flashes produced when, here and there, a radium atom blows up by throwing out a high-speed particle. Atoms are so numerous that this can go on for thousands of years without using up all the original bit of radium.
—*Science Illustrated.*

I. A. Elections

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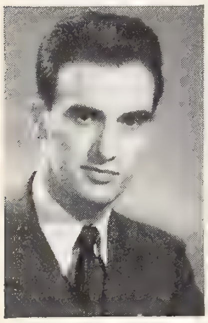
PERSONNEL

Harry Strong, Strong Electric Corp., Toledo, manufacturer of projection arc lamps, has announced the appointment of two ex-servicemen to key positions with his company.

Lt. Commander W. D. "Dick" Myers, U.S.N.R., who has returned from the South



Al Boudouris ***Dick Myers***

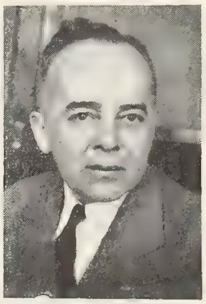
Pacific and Phillipines where he was engaged in radar work on carriers and seaplane tenders, will serve as research engineer with the Strong organization. He has been associated with the theatre industry since 1928, mainly in sound engineering for Western Electric and Warner Brothers.

Ensign A. B. "Al" Boudouris, U.S.N.R., Navy pilot specializing in radar work, has returned to the Strong organization as field engineer. Bourdouris was associated wtih Strong prior to entering the Navy and has a host of friends in the theatre field.

• • •

E. O. Kollmorgen, for the past 5 years executive vice-president, has been named president of Kollmorgen Optical Corp., 2 Franklin Ave., Brooklyn, N. Y. He succeeds George L. Haas, who has headed the corporation for many years. Retirement of Dr. Frederick Kollmorgen, board chairman, also was made known. Ownership of the coroporation remains unchanged.

John L. Maulbetsch, production and engineering vice-president, has been appointed vice-president and general manager. William



J. L. Maulbetsch ***E. O. Kollmorgen***

A. Rudd, comptroller, has been named treasurer.

Kollmorgen Optical Corp. had its origin in 1916 when it began the manufacture of periscopes for the expanding submarine service of the United States Navy. The new company made important contributions to the utility and efficiency of the periscope. It likewise produced motion picture projection lenses, devised one of the first successful optical systems for sound-on-film, and made the first contact lenses in America.

In 1940 Kollmorgen once more became the foremost supplier of periscopes to the Navy, and produced navigational aids and fire control equipment. Postwar products include "Spectel" telescopic spectacles, spectacle frames, "Snaplite" film projection lenses, and television optical systems.

• • •

Lt. N. D. Russell recently discharged from the U. S. Navy, has returned to the Altec Service Corporation as an inspector in the New Orleans territory

Lt. Russell's experience as a motion picture and sound technician dates back to the days of ERPI in 1928, and later with Altec in the Birmingham territory. In 1942 he was called by the Navy and received a lieutenant's commission. For the past year he had been in charge of the Naval Training Center, Bainbridge, Md. Sound Motion Picture Technician School for the training of officers and service men in motion picture operation and repair.

• • •

Three veteran RCA theatre equipment specialists have been appointed as sales representatives in the Chicago, Southeastern and Southwestern areas, it is announced by the theatre equipment department of the RCA Victor Division.

R. W. Amos, named to the sales post for the Dallas-Houston-Oklahoma City area, has been with RCA for 16 years, serving last as field engineer in the Dallas district. Michael J. Yahr, appointed salesman for the Chicago-Indianapolis area, most recently was with the RCA Victor plant in Indianapolis. Clay Stelling, new sales representative in the Southeastern section, covering Charlotte, Atlanta and Jacksonville, formerly served as RCA field engineer in the Atlanta region.

• • •

Frank J. Feely, manager of Western Electric Specialty Products Shops in New Jersey, has been appointed manager of the Company's electronic components manufacture. These operations will be moved into a new plant to be constructed during the coming year at Allentown, Pa. Since 1942 Mr. Feely has been responsible for much of W. E.'s production of radar and other electronic equipment for the Armed Forces, and brings to his new assignment 25 years of manufacturing experience in the company.

IN THE SPOTLIGHT

(*Continued from page* 19)

ing, was attended by over 800 guests and it was the unanimous opinion of all those with whom we spoke that the success of the party was due to the splendid handling of all arrangements. Serving on the Arrangements Committee were: Tom Murtha, Brooklyn Local No. 4; J. C. McDowell and Joe Dwyer, New York City Local No. 1; H. Paul Shay, Elmira Local No. 289; Don Rood, Utica Local No. 128; M. J. Mungovan, Rochester Local No. 25; Arthur Martens, Westchester County Local No. 650; Albert F. Ryde, Buffalo Local No. 233; James J. Murphy, New York Treasurers' Local No. 751, and Sal Scoppa, New

York Studio Mechanics' Local No. 52. Take a bow, boys.

● We notice in the election reports for Rochester Local No. 253 that Leon E. Burton and Floyd B. Spencer were re-elected to office. Burton has been treasurer of the local since 1918, and Spencer has been secretary almost consistently since 1927. That is quite a record and is conclusive proof of their popularity with the membership. Incidentally, most of the elected officers of this local are also members of the 25-30 Club.

INTERNATIONAL

PROJECTIONIST

FEBRUARY 1946

VOLUME 21 • NUMBER 2

25c A COPY • $2 A YEAR

Let your HEAD take you

(The average American today has a choice of just going where "his feet take him", or choosing wisely the course to follow. Let's skip ahead 10 years, and take a look at John Jones—and listen to him . . .)

"SOMETIMES I feel so good it almost scares me.

"This house—I wouldn't swap a shingle off its roof for any other house on earth. This little valley, with the pond down in the hollow at the back, is the spot I like best in all the world.

"And they're mine. I own 'em. Nobody can take 'em away from me.

"I've got a little money coming in, regularly. Not much—but enough. And I tell you, when you can go to bed every night with nothing on your mind except the fun you're going to have tomorrow—that's as near Heaven as man gets on this earth!

"It wasn't always so.

"Back in '46—that was right after the war and sometimes the going wasn't too easy—I needed cash. Taxes were tough, and then Ellen got sick. Like almost everybody else, I was buying Bonds through the Payroll Plan—and I figured on cashing some of them in. But sick as she was, it was Ellen who talked me out of it.

" 'Don't do it, John!' she said. 'Please don't! For the first time in our lives, we're really saving money. It's wonderful to know that every single payday we have more money put aside! John, if we can only keep up this saving, think what it can mean! Maybe someday you won't have to work. Maybe we can own a home. And oh, how good it would feel to know that we need never worry about money when we're old!'

"Well, even after she got better, I stayed away from the weekly poker game—quit dropping a little cash at the hot spots now and then—gave up some of the things a man feels he has a right to. We didn't have as much fun for a while but we paid our taxes and the doctor and—we didn't touch the Bonds.

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"WHY LOOK AT A PICTURE LIKE THIS...?"

INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

HENRY B. SELLWOOD, *Editor*

Volume 21 FEBRUARY 1946 *Number 2*

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MONTHLY CHAT

FILM exhibitors have never been conspicuous for their interest in the technological standards of the industry—unless and until some topic bearing, however remotely, on theatre manpower hoves into view. When this happens, every exhibitor in America essays the role of a Ph.D. in science—*all* the sciences—usually with ludicrous results.

The current exhibitor bleat in behalf of acetate film makes them hammier than ever. We don't object to exhibitors sounding off; but we do think that the prestige of the industry demands that they obtain competent technical advice before they cuff people around. The M.P.T.O.A. is welcome to the data anent the acetate vs. nitrate topic presented elsewhere in this issue—without charge.

• • •

The M.P.T.O.A. might better give serious consideration to other—and, we think, more pressing—problems currently confronting the industry, notably the threat to the box-office of television and of the projected circuit of 16-mm theatres, including mobile units. The 16-mm situation demands immediate attention, although television is on the wing and coming fast. If and when pressure from both these quarters is exerted simultaneously, as it will be, the pay of a projectionist will seem to be a comparatively small potato. Incidentally, has the M.P.T.O.A., or the Allied owners, *or* the producers ever spent an hour or a dollar to evaluate the position of the motion picture theatre in the television era?

Developments such as these is the reason why I. P. is a *craft* publication no less than a technical journal. There are some things vastly more important than corporate quarterly earnings and weekly salary payments, and among these is long-range security, no less for the theatreman's investment than for the projectionist's weekly wage.

So it is, I. P. readers, when you see in these pages items and articles that may not be classified as technical presentations—and we include in this category items relating to film company earnings, etc.—just remember that this bit of type helps to fill in the overall pattern and is a function of I. P.'s service as a *craft* journal.

The 16-mm people are very much alive to the possibilities of a national narrow-gauge exhibition circuit, the establishment of which would occasion no great surprise in this corner. All the major producers are preparing to make 16-mm prints, although they disclaim any intention to distribute them in the U. S. A. This still leaves the exhibition field high and dry in terms of security.

• • •

The producers' association has hired two Ph.D.'s as the nucleus of a fact-finding and statistical research department. What are *we* waiting for—to be slugged by a ton of graph paper?


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INTERNATIONAL PROJECTIONIST

VOLUME XXI FEBRUARY 1946 NUMBER 2

Some Physical Properties of Film Relating to Image Stability†

By *R. H. TALBOT*
EASTMAN KODAK COMPANY

Tolerances of the order of ten thousandths of an inch, and more, have been commonplace in motion picture engineering. Nowhere in the reproduction process are these exacting requirements more pronounced than in the relationship between film width and projector performance. The accompanying article details in interesting fashion the magnificent job done by the industry's technical forces in maintaining high standards of performance.

IT IS THE purpose of this article to consider the relation of a few film characteristics to certain problems in the laboratory and in the theatre projection room. The problems selected for discussion are image distortion and film defects resulting from insufficient drying.

As a rule, a small amount of distortion of either the negative image or the positive image does not detract noticeably from the usefulness of the motion picture print. There are, however, certain special fields in which the matter of image distortion has become increasingly important. These fields include color photography, special-effects photography, and certain applications of photography for military use.

An image on photographic film should not be considered as stable as one on glass or steel. Actually, the image on a piece of film is changing in size or shape continually throughout its life. Distortion of the photographic image is generally the result of shrinkage owing to loss of volatile materials, expansion or contraction produced by changes in moisture content, and failure of the printer to transfer the exact dimensions of the negative image onto the positive film.

The magnitude of these distortions can be illustrated by selecting a test object of known dimensions, photographing it, and following the dimensional changes in the photographic image of the object throughout the life of the film.

A suitable object may be a test target, as illustrated in Figure 1, constructed on a dimensionally stable material such as glass. The target is 1.378 in. (35-mm) wide and of any convient height. It consists of 4 fine lines *A*, *B*, *C*, and *D*. For convenience, line *A* is located 0.2000 in. from edge *O*, and line *B* is located 1.0000 in. from edge *O*. Lines *C* and *D* are 0.5000 in. apart.

The image of this target is now transferred to a piece of 35-mm negative film by contact printing, perfect alignment of target and film at edge *O* being maintained when the exposure is made. There has now been produced on the 35-mm film a latent image whose dimensions are identical with those of the test target. The film is then processed.

It will be found that the dimensions of the developed image on the film do not coincide exactly with those of the target. If care is taken to bring the negative film to equilibrium with air at the same relative humidity after processing as that of the air with which it was in equilibrium at the time of exposure, any dimensional changes will be caused solely by processing.

Processing Shrinkage Figures

The permanent processing shrinkage of Eastman motion picture negative film (nitrate base) is of the order of 0.10 per cent in length and 0.15 per cent in width. Therefore, upon measurement of the image lines after processing, it will be found that line *A* has moved 0.0003 in. toward edge *O* from its original position, and that line *B* has moved 0.0015 in. toward edge *O*. Lines *C* and *D* are now 0.4995 in. apart.

Ordinarily, it is not necessary to maintain the processed negative in equilibrium with air at the same relative humidity as that with which it was in equilibrium at the time of printing. However, in the special cases noted, the changes in dimensions which accompany changes in moisture content of the negative become an important factor.

It may be assumed that most negative raw stock, when removed from the container, is in equilibrium with air at about 60 per cent relative humidity. If the negative, after processing, is stored in a dry place, there will be a further shrinkage of the temporary or reversible type caused by loss of moisture. Thus, if the negative were stored in a vault in which the relative humidity of the

† *J. Soc. Mot. Pic. Eng., Sept.,* 1945.

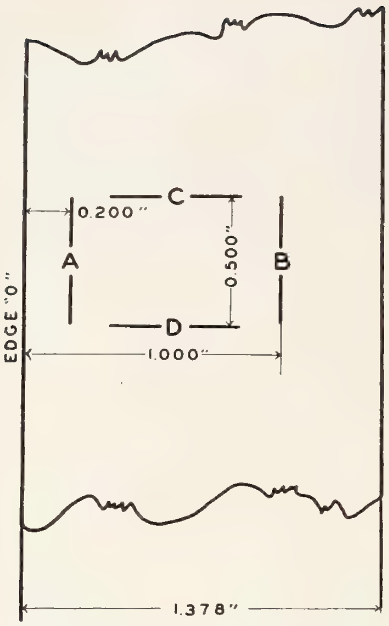


FIGURE 1. ***Test target on glass for image distortion study.***

air averaged 20 per cent, there would be a contraction of about 0.20 per cent lengthwise and 0.25 per cent widthwise owing to the loss of moisture.

These dimensional changes are in addition to the permanent shrinkage caused by development. Consequently, line *A* has now moved a total of 0.0008 in. toward edge *O*, line *B* has moved a total of 0.004 in. toward edge *O*, and lines *C* and *D* are 0.4985 in. apart.

This is not all. There will be further permanent shrinkage on storage, owing to a gradual loss of traces of solvent or plasticizer from the processed negative. The shrinkage of Eastman nitrate motion picture negative film resulting from loss of material upon storage under normal conditions for one year is approximately 0.3 per cent lengthwise and 0.4 per cent widthwise. Consequently, after one year, under normal keeping conditions, the following shrinkages of the negative may have taken place:

	Lengthwise, per cent	Widthwise, per cent
Processing shrinkage	0.10	0.15
Humidity change contraction	0.20	0.25
Keeping shrinkage (1 year)	0.30	0.40
	0.60	0.80

The positions of lines *A* and *B* will be 0.0016 in. and 0.008 in., respectively, closer to edge *O* than in their original positions, and lines *C* and *D* will be 0.4970 in. apart.

Ordinarily, distortions of this magnitude have little or no signficance when the negatives are used for normal printing. In special cases where distortions of this amount are objectionable, the dimensional changes accompanying variations in moisture content can be kept at a minimum by reconditioning the negative to 60 per cent relative humidity. The shrinkage during keeping can be minimized by storing the negatives in sealed containers at about 50-60 F and at 40-50 per cent relative humidity, when not in use.

The positive print, after exposure to the negative, is subject to the same general dimensional changes which have been described in the case of the negative. That is, there will be a shrinkage upon development, dimensional changes produced by variations in the moisture content, and shrinkage upon storage owing to the loss of solvent or plasticizer. It would be possible, therefore, in the very unusual case in which all dimensional changes in the negative at the time of printing were as great as possible and all additive, and in which subsequent to printing the dimensional changes of the positive were as great as possible and all additive, to have displacements of certain lines in the print of the order of 0.02 in. from those of the original subject.

Contact Printing Distortions

In contact printing, the negative and positive are brought together, emulsion layer to emulsion layer, and the exposure is made. At first thought, one would expect that an exact reproduction of the negative image would in all cases be recorded on the positive. In a step printer, in which each frame of the negative is held in contact with the positive film in a flat plane when the exposure is made, this is substantially true.

In the case of a continuous printer, in which the exposure is made after the negative and positive are brought in contact on the curved surface of a drum, the image of the negative is not transferred unchanged in all respects to the positive.

In Figure 2, which illustrates a portion of a continuous printer, it may be seen that the negative film travels in a circular path which is shorter than that of the positive. Thus, for a drum of 1.887-in. radius, as on the standard Bell and Howell Model *D* printer, and assuming that the neutral axis of the film is at the center, the path of the negative is 0.317 per cent shorter than that of the positive. If the perforation pitch of the positive is equal to that of the negative, the positive film must gain its greater distance of travel by slipping past the negative film during exposure to the extent of 0.317 per cent.

In practice it is usually found that the positive film is unshrunk and that the negative, because of processing and the time interval which exists between processing and printing, has shrunk nearly 0.2-0.3 per cent. When such is the case, printing on a continuous printer is quite satisfactory. The pitch of the negative must be approximately 0.3 per cent less than that of the positive, or the picture will appear slightly unsteady and the sound will be slightly distorted.

These considerations in regard to continuous printing are quite obvious and certainly well understood. There is, howeverever, another effect which takes place when the exposure is made while the negative and positive are in contact on a curved surface which is not so generally appreciated.

When any elastic material is bent, the concave side is compressed, and the convex side is stretched (Figure 3). Therefore, on a continuous printer, the emulsion side of the positive film is compressed, and the emulsion side of the negative is stretched at the instant of exposure. Obviously, this effect will make it impossible to reproduce exactly longitudinal dimensions of the negative onto the positive by this manner of printing.

Assuming again that the neutral axis of the film lies at its center, the positive emulsion surface has been compressed longitudinally 0.317/2 or 0.158 per cent, and the negative emulsion surface has been stretched 0.158 per cent at the instant of exposure. When the positive film returns to its normal or flat position, the emulsion surface will expand 0.158 per cent, giving a total longitudinal increase in dimensions of 0.317 per cent. This degree of distortion is so small as to be inconsequential in the case of ordinary usage. It is only in connection with the special fields noted that it is of significance.

Up to this point we have considered the distortion of the image on the film itself. In certain cases this image will be projected either onto another film or onto a screen. When this is done, dis-

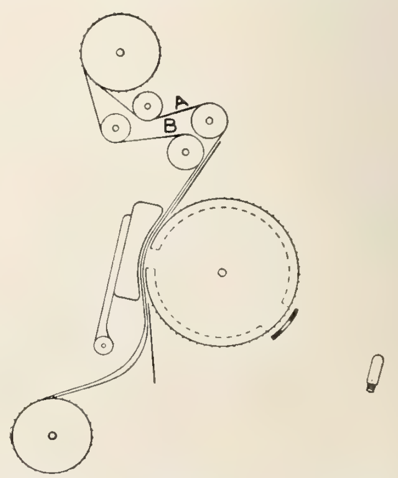
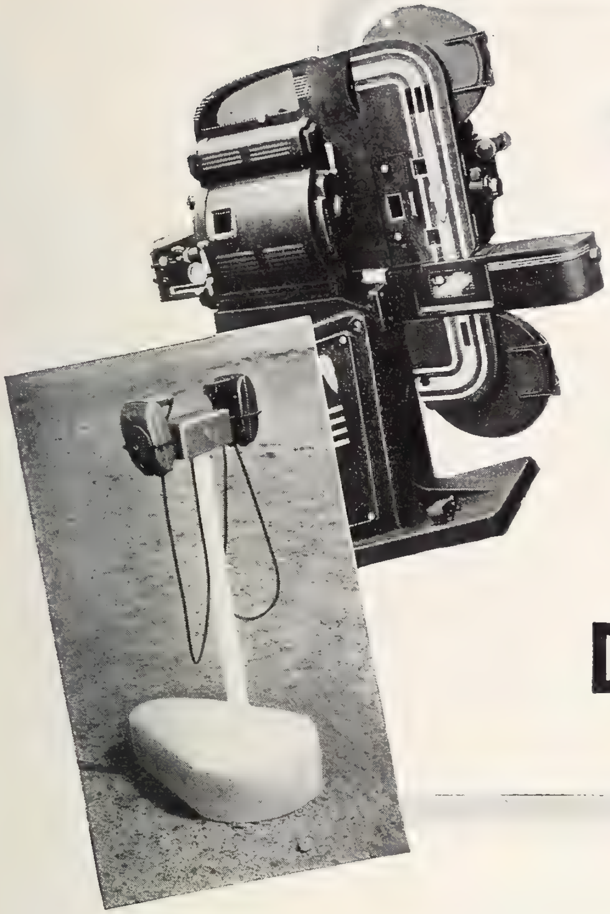


FIGURE 2. ***Film paths on a typical continuous Printer: (A) Path of the negative; (B) Path of the positive.***



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THEATRE EQUIPMENT

RADIO CORPORATION of AMERICA

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tortion of an entirely different nature may be encountered.

The heat of the projector lamp frequently causes the film to assume a curved shape during the instant the film is in the aperture of the projector. This curvature of the film produces distortion in the projected image. In the case of theatre projection, these distortions are seldom noticeable. In special cases, where little or no distortion of the projected image is permissible, it will be necessary to reduce the heat intensity at the film surface with heat-absorbing media to the point at which these image distortions disappear.

Insufficient Drying Defects

Although a great many studies have been made of most of the steps in film processing, very little has been published on the subject of the drying of film. There are great differences of opinion in regard to the best conditions for drying. Most of the steps in the laboratory handling of film from printing to screening are controlled by a practical evaluation of the results obtained. For instance, if too much light is used in printing, the resulting print appears too dark on the screen and the necessary correction is made in the case of succeeding prints. If the processing solutions are not correct, a print of too high or too low a degree of contrast may result. An adjustment is, therefore, made in the time of processing or in the solutions.

However, in the case of the drying of film, a step which affects the appearance and operation of the print for the remainder of its useful life, there is no simple guide for the processing superintendent. The only guide he has, the appearance of the film, may be deceiving. Admittedly, the operator can see when the film is "sensibly dry," but this observation applies only to the emulsion layer. It tells him nothing concerning the dryness of the base.

It is possible, when drying fine-grain emulsion films at a low dry-bulb temperature and low relative humidity, to reel the film with the emulsion layer practically in equilibrium with the air of the drying cabinet, but with the base only in partial equilibrium with the air of the drying cabinet. This results from the fact that the emulsion layer reaches equilibrium with air at a much more rapid rate than does the base.

When films dried in this manner are reeled, moisture is transferred from the base to the emulsion until the 2 layers are in a state of moisture equilibrium. This effect is illustrated in Figure 4. In these examples, samples of film were suspended in air at 50 per cent RH (relative humidity) for 2 different periods; the first was allowed to stay for a considerable time, and the second was removed as soon as it appeared "sensibly dry."

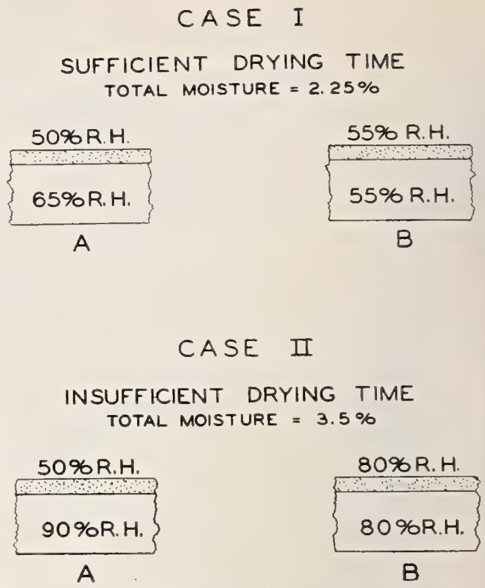

FIGURE 4. ***Effect of drying time on moisture distribution in motion picture positive film: (A) Relative humidity with which each layer is in equilibrium at end of drying period; (B) Relative humidity with which each layer is in equilibrium after standing in roll form.***

Emulsion vs. Base Drying

The first sample in Figure 4 contained 2.25 per cent moisture by weight, and if allowed to equilibrate without loss or gain would have been in equilibrium with air at 55 per cent RH. Because the emulsion dries so rapidly, however, at the same time the sample was removed for analysis the emulsion had gone substantially all the way toward equilibrium with the air at 50 per cent RH. Yet the base with its much slower drying rate had gone only 70 per cent of the way, and still contained enough water to be in equilibrium with air at 65 per cent RH. It is only after several hours' equilibration (wound in a roll, for example) that both emulsion and base would attain the over-all equilibrium of 55 per cent RH.

The second sample, which was removed as soon as it showed the change in the direction of curl associated with "sensible dryness," contained 3.5 per cent moisture by weight, sufficient so that if allowed to equilibrate without further loss or gain, it would have been in equilibrium with air at 80 per cent RH. Nevertheless, the emulsion, at the time the sample was taken, had, as before, dried almost completely to equilibrium with air at 50 per cent RH.

Only in the base was the short drying time apparent, for here the base had had the opportunity to go only 20 per cent of the way toward equilibrium with air at 50 per cent RH. It was as if a strip of emulsion at 50 per cent had been cemented to a strip of base at 90 per cent; the resulting film on equilibration of base with emulsion eventually reaches equilibrium with air at 80 per cent RH.

Even though, at the time the samples were taken, these 2 films looked and felt equally satisfactory, it is now apparent that only the first strip was sufficiently dried. The second strip with its high moisture content is subject to many defects directly caused by the moisture still present at the time of reeling. Defects often found on films dried in this manner are:

(*a*) Tackiness of the emulsion, causing sticking in the projector gates,

(*b*) High positive curl. This is especially true if the relative humidity of the drying cabinet air is very low and the time of drying very short. Film with high curl will, when wound into rolls, frequently show "spokiness" or, in the case of safety film, bad twist,

(*c*) Buckle, caused by the edges of the film drying more rapidly than the center and thereby becoming shorter. This distortion will frequently cause the picture to appear out of focus momentarily,

(*d*) Thermal "in-and-out" of focus. This is a phenomenon associated generally with the use of high-intensity lamps. It is aggravated by a high moisture content in the film.

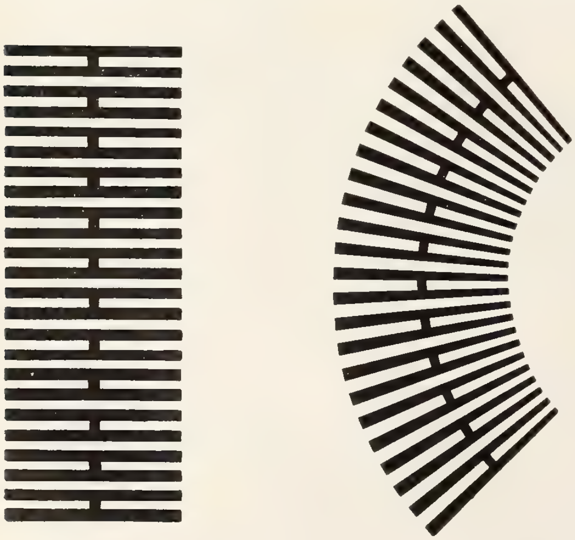

FIGURE 3.

Compression and extension effect on bending an elastic material.

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The New Ampro 16-mm Projector

By *LEROY CHADBOURNE*

II—Step-by-Step Analysis of Sound Circuit†

IN the lower right-hand corner of Fig. 1 the wiring of the motor and automatic speed control of the Ampro Premier 10 sound projector is shown as a separate circuit. Power input is applied to the terminals designated Y, Y. At the extreme left of the motor circuit is switch Sw-6, a simple double-pole, double-throw switch wired as a polarity reverser. The motor is a universal (series) type which may be operated on either a. c. or d. c.

The function of Sw-6 is to reverse the polarity of the armature with reference to the fields, thus reversing the direction of rotation regardless of which type of power supply is used. Sw-6 is thrown over for rewinding, and also when it is desired to project film backward; also (in educational work particularly) when it is desired to go back a short distance in order to show the same section of film a second time.

The two blades of Sw-6 are connected by a dotted line, indicating that these blades work together and that the switch is of the normal d.p.d.t. type. When these blades are closed to the two upper terminals, a circuit may be traced as follows: from the upper Y left through the field coil, down through the right-hand switch-blade, right, up through R-25, to the *right* through the armature; then down, left, up to the left-hand switch blade, diagonally right and down, and to the right through the lower field coil to lower Y.

With the switch blades closed downward, the circuit (tracing as before from the upper Y) is to the left through the field coil as before, then left, down and diagonally left to the left-hand switch blade; down, right, up and *left* through the armature; thence left and down through R-25, left, down through the right-hand switch blade; then right and out as before through the lower field coil to lower Y.

Between the armature and Sw-6 the reader will see drawn two condensers, the resistor R-25, an uncommon circuit arrangement designed by X, X, and the single-blade, single-throw switch, Sw-5. This is the automatic speed regulator, or electrical governor. It is built for two-speed operation: 1,000 r.p.m. for silent projection; 1,440 r.p.m. for sound pictures.

In physical construction this device consists of a fibre disc, rotating rapidly, and carrying the contacts X, X, on the back of the disc. On the face of the disc are three concentric slip-rings to which current is supplied through three carbon brushes. One brush is represented in this diagram by the connection to the top of the left-hand X, another by the connection to the top of the right-hand X, and the third by the common return from the bottom of both X's.

The physical contacts, X, X, are much like those made in a telephone jack, or in a jack switch. There are springy prongs carrying contact points. Contacts normally are closed. These contacts, however, are not opened by insertion of a plug (there is nothing in which to insert a plug) or by manipulating a toggle, but merely by centrifugal force when the spinning disc reaches a pre-determined speed. The contact-bearing prong of the right-hand X, having less tension, will open first.

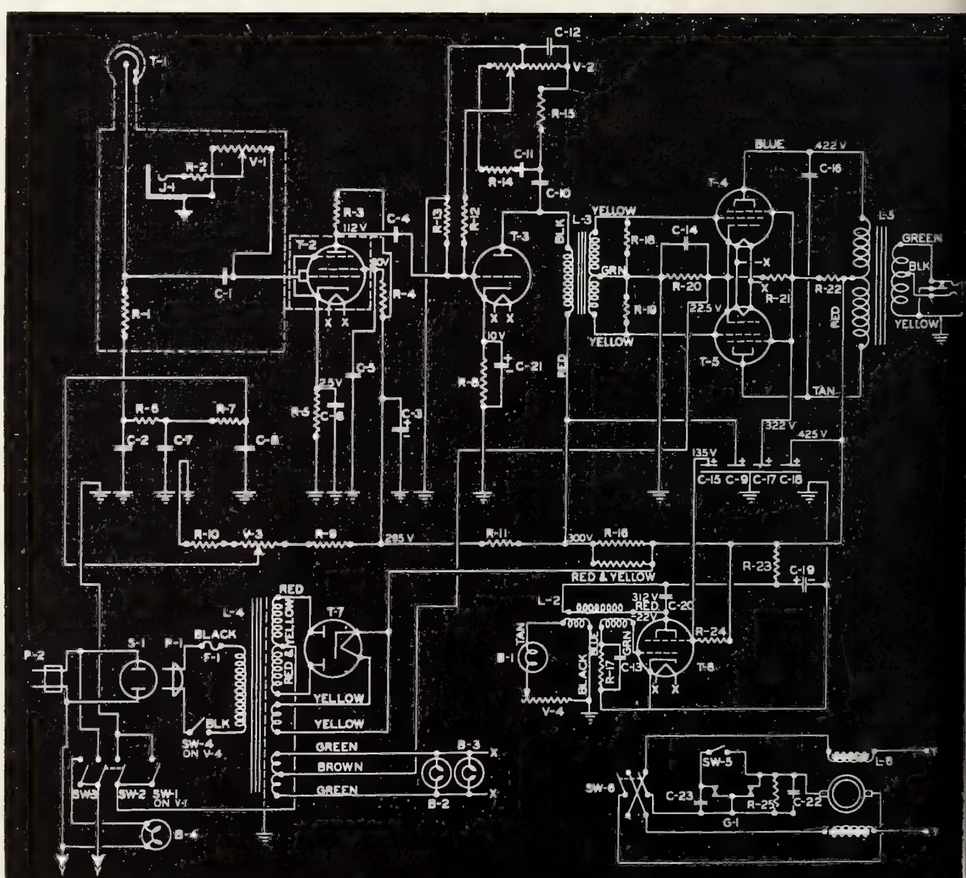
In the drawing as shown, Sw-5 is open, therefore the left-hand X contact is open-circuited and thus inoperative. Whether it opens or stays closed as the disc whirls faster makes no difference at all: there is no current through it as long as Sw-5 remains open. But as long as the right-hand contact remains closed, R-25, the armature series resistor, is short-circuited by the right-hand X. When motor speed reaches the point at which the righthand X is thrown open, R-25 is effectively in series with the armature, thus slowing down the motor. In actual operation there is a very rapid opening and closing of the centrifugal contact, which holds the motor to constant speed at 1,000 r.p.m.

General Power Circuits

When Sw-5 is closed for sound operation at 1,440 r.p.m., opening of the right-hand X at 1,000 r.p.m. has no effect at all, as long as the left-hand X remains closed and continues to provide a short-circuit around R-25. Left-hand X opens when speed exceeds 1,440, and controls the motor at that speed.

At the left of Fig. 1, near the bottom, there is a plug, P-2, which connects to the power source. From top and bottom

FIGURE 1



† This is the second and concluding article relative to the Ampro 16-mm projector. Constructional and operational features were discussed in the last, Jan. 1946, issue.—ED.

of this plug trace straight right to receptacle S-1. Plug P-1 makes contact with this receptacle, supplying power to the amplifier transformer primary, through fuse F-1 and through switch Sw-4, which switch is mounted on the volume control and is open when that control is completely retarded. This volume control is the rheostat in the exciter lamp circuit.

From the bottom of the plug, P-2, at the extreme left, trace straight down to Y, which is one of the two input terminals of the motor circuit already examined; then also trace straight right to the lower terminal of B-4, the projection lamp. From the top lamp terminal trace left, up, down through the s.p.s.t. switch, Sw-3, right to the left-hand blade of Sw-2, and thence up to the top of plug P-2. From the left-hand pole of the d.p.s.t. switch Sw-2 also trace straight down to other motor circuit terminal, Y.

Sw-3 is the projection lamp switch, but since the left blade of Sw-2 is in series with it, the lamp cannot be lit unless Sw-2 is closed, setting the motor into operation and thus causing the blower to cool the projection lamp.

When the motor switch Sw-2 is closed, its right-hand blade grounds the center-tap of the amplifier secondary. About an inch above plug P-2, and stretching off to the right, there is a row of ground (chassis) connections. From the one at the extreme left trace down, through the right-hand blade of Sw-2, and then right and up to midpoint of the amplifier power transformer secondary.

If Sw-2 is not closed, Sw-1, next to it, will complete this same ground connection automatically when the microphone volume control (V-1, near top left of the drawing) is manipulated. Thus the amplifier can be used, without projector operation, for announcements and non-synch. However, the exciter lamp rheostat V-4 must be slightly advanced to close Sw-4, which is in series with the primary of the amplifier power transformer.

In general, as I. P. readers know, there are two types of schematics which differ according to the way the draftsman chooses to represent crossing of wires that do not touch each other, as compared with crossing or meeting of wires that make connection. In one type, little dots are used at a crossing or meeting point to indicate that the wires connect; where wires cross without any such dot there is no electrical contact. In the other type, the little dots are not used: every contact between lines indicates electrical connection unless one line loops over the other.

In Fig. 1 the draftsman has resorted to a slightly different method. Where lines cross without electrical connection one line or the other has been interrupted. This *does not* mean that the actual wire is open. It should be traced as if it were continuous. In addition, and for double clarity, the usual little dots are used where connection is intended—except at the sockets where they indicate only tube prongs.

The lowest secondary on the amplifier transformer supplies two lamps: B-2, a dial lamp, and B-3, the threading lamp. Additionally, through terminals X, X, this secondary heats the filaments of all tubes except the rectifier.

The middle secondary heats the rectifier filament, and its lower end is tied to the rectifier cathode. The center-tapped upper secondary supplies the two plates of the rectifier in a conventional circuit.

From the cathode, the positive terminal of the rectifier tube, trace right, up, right, up to the right-hand side of R-16; then to the right, up and right to the center tap of the output transformer primary. Through the two halves of this primary trace to the two plates of the output tubes. From the cathodes of those tubes left through R-20 and down to the chassis. From the extreme left-hand ground in the row of chassis connections trace down through the right-hand blade of Sw-2 (or through the single blade of Sw-1, according to circumstances) and right and up to the center tap of the power transformer secondary.

Amplifier Power Lines

The center tap is the negative terminal of the rectifier circuit. The power source may conveniently be considered to consist of whichever half of the transformer is positive at the moment, and the rectifier plate associated therewith.

Proceeding as before to the center tap of the output transformer primary, follow left through R-22 to the screen grids of the output tubes. The return to negative is through the cathodes of those tubes, as previously.

Beginning as before at the cathode of the rectifier, trace right, up and right and up to the right-hand side of R-16. Thence right, down through R-23, left, down and right through the plate oscillator coil L-2 to the plate of the oscillator tube. Returning to the right-hand side of R-16, trace right, down and left through R-24 to the oscillator screen. From the oscillator cathode trace down, right and up to ground; from ground back to the negative side of the rectifier, as before.

From the right-hand side of R-16 trace left through R-16 and up to the plate of T-3. From the cathode of T-3 to ground through R-8. From the left-hand end of R-16 trace left through R-11 and up, right a trifle under R-4, around R-4 and up, left and down through R-3 to the plate of T-2. From the bottom of R-4 trace through R-4 to the screen of T-2. From the cathode of T-2 trace to ground through R-5.

Returning to R-16, follow left through R-9, V-3 (note the slider), R-10 and up, right and down to ground. A portion of the voltage drop existing across R-10 and V-3 can be tapped off by V-3's slider and applied to the PEC. From the slider trace left, up, right, down, left through R-7 and R-6, and up through R-1 to the PEC anode. The PEC cathode is grounded to shield, which is in intimate physical contact with the chassis.

Returning to R-16, trace right, up to the first connection, and left and down to C-18, the lower plate of which is grounded. C-18 helps filter the supply to the plates of the output tubes. The other condensers in this combination capacitor serve similar purposes. By tracing the connections from their positive sides, it will readily be seen that C-17 helps filter the output tubes' screen supply; C-9 performs a similar function for the plate of T-3, and C-15 for the screen of the oscillator tube. Oscillator plate power is filtered in part by C-19, just right of R-23. C-3 helps filter plate and screen supply to T-2; C-2, C-7 and C-8 add additional filtering to the PEC line. All of the condensers mentioned in this paragraph act as filters by helping shunt ripple to ground.

In the oscillator tube circuits, grid returns to cathode through the grid coil and through R-17, which is bridged by C-13. Plate returns to cathode through the plate coil (which is shunted by C-20) and C-19. The inductive relations between the plate and grid coil are such as to produce a reinforcing (not inverse) feedback from plate to grid.

Plate and grid circuits may be regarded as each being a band-pass filter circuit. If they are tuned to the same frequency by suitable selection of their inductance, capacitance and resistance values, the positive feedback between plate and grid will produce oscillation, or cause the plate current to fluctuate, at that frequency.

Just left of the grid coil is another coil which will act as a transformer secondary when fluctuations appear in the plate coil, the latter coil acting as transformer primary. Alternating voltage will be generated in this secondary at the frequency of the fluctuations in the primary coil. Since the transformer arrangement is step-down, the induced voltage will be lower than the primary (plate coil) voltage, and the induced current higher. This secondary coil is the source of the a. c. (at a frequency too high to be audible) which lights the exciter filament through rheostat V-4.

V-4, which controls the intensity of exciter illumination, is used as the

volume control of the amplifier. Mounted on the same unit and operated by the same knob is switch Sw-4 which controls the amplifier power transformer primary.

Grid Bias Circuits

The control grid of T-2 may be traced to ground (follow left and up) through V-1 and J-1. Since no current flows through V-1 except when microphone or non-synch is plugged in, there is no d. c. voltage drop across it, and T-2 grid is at ground potential. The cathode of T-2 returns to ground through R-5. The plate and screen currents of that tube complete their circuit to ground through R-5, therefore a voltage drop exists across it; the cathode is positive with respect to ground (and grid) by the extent of the voltage drop through R-5, namely 2.5 volts. This is the same as saying that the grid is negative with respect to cathode by 2.5 volts.

The grid of T-3 is traced to ground through R-13. Since there is no d. c. in R-13, grid is at d. c. ground potential. Cathode is 10 volts above ground potential by reason of the plate current voltage drop in R-8. The grid bias of T-3 is therefore 10 volts negative.

The control grids of T-4 and T-5 can be traced to ground as follows: left, through the coupling transformer secondary to midtap, right to the left-hand side of R-20, thence down to ground. But R-20 also carries the plate and screen currents of those two tubes from cathodes to ground. The grids of the output tubes are therefore negative to cathode by the extent of the voltage drop through R-20.

The oscillator tube is not given a grid bias, but it develops one. Since pulsating d. c. appears in the plate coil, a. c. at corresponding frequency is induced into the grid coil, and the grid therefore tends to swing positive and negative. When the grid is positive it attracts electrons; when it swings negative those electrons have no way of getting off the grid except by leaking to ground through R-17. The time constant of R-17 and C-13 delays some of them, and a negative d. c. potential builds up on the grid, upon which constant potential the generated a. c. is superimposed. The grid bias thus created is minus 22 volts.

Regarding anode and cathode of the PEC as sources of speech voltage, the circuit can be traced from anode down and right through C-1 to T-2 grid; from PEC cathode to ground and thence up through C-6 to T-2 cathode. The mike-non-synch input is effectively a parallel circuit, through V-1 and R-2.

Regarding plate and cathode of T-2 as sources of amplified speech voltage, trace from plate to the right through C-4 to grid of T-3. Trace from T-2 cathode through C-6 to ground, then from ground up through C-21 to T-3 cathode.

Treating plate and cathode of T-3 as sources of speech voltage further amplified, trace from plate through L-3 primary, down, right and down through C-9 to ground. From cathode down through C-21 to ground. From the two ends of the secondary of L-3 trace to the control grids of T-4 and T-5. From the center tap of that secondary trace through R-20 to the cathodes of those tubes.

The upper half of L-5 primary supplies the speech load upon plate and cathode of the upper tube; the lower half of L-5 primary does the same for the lower tube.

The secondary of L-5 is tapped to give a choice of two impedances, and the plug fitting into the output jack can be wired accordingly. When no plug is inserted, this secondary is short-circuited by an auxiliary contact on the jack, and at all times one side is grounded.

Inverse Feedback

Returning to the output of L-3: R-20, R-21, and R-22 may be regarded as a voltage divider. R-20 is also the cathode return, grid bias resistor, and the voltage divider curent through it adds to the plate-screen current through it to produce a 22.5 volt grid bias. C-14 by-passes speech current around R-20. R-18, R-19 and C-16 (near the plate of T-4) are inserted to secure superior frequency response.

Return to the plate and grid circuits of T-3, which are interconnected by a resistor-condenser network. This provides both inverse feedback in that stage and also tone control. Since this tone control is in an inverse feedback circuit, the more high frequencies it feeds back the weaker will be the h.f. response in the loudspeaker; the more lows it feeds back, the weaker will be the l.f. response.

One feedback path can be traced up through C-10, through R-15, left through C-12, right and down to grid through R-13. A parallel path exists, left from the top of R-15 through V-2, thence to grid through slider and R-12.

The slider is drawn a little left of V-2 midpoint. Set at midpoint, tone would be "normal." If this slider were set all the way right, it would largely by-pass V-12, since R-12 and R-13 are nearly the same value. More lows would get back to grid, resulting in *weaker* l.f. response in the speaker.

Once the slider is moved left of midpoint, it has increasingly less effect on the current through C-12, which will more and more complete its path to grid through R-13. But there still is another feedback line: from plate up through C-10, left through C-11 and R-14, thence up and right to the slider. Feedback through this line begins to assume significance as the slider approaches left-hand position. When the slider is at extreme left position, a large part of the feedback is that which arrives at grid through either C-11 or C-12. It therefore contains a minimum of low frequencies, with resulting *stronger* l.f. response at the speaker.

The converse effect is produced on high frequencies at every different position of the slider.

We See Upside Down

WHEN a simple lens casts an image, the image is reversed both up and down and side to side. Use the lens of an ordinary reading glass to throw an image of a lamp on a sheet of paper, or look at the image on the ground glass screen of a camera, and see that this is true.

The eye is often compared with a camera, and rightly so. Like a camera, the eye has a lens system that bends the entering light, forming an image of what is seen on the retina, or sensitive back surface of the eyeball. The pupil—the round opening at the front of the eye—controls the amount of light that enters, just as the diaphragm of a camera lens does.

If the eye acts like a miniature camera, then the image on the retina must be upside down. Why, then, do we not see things turned wrong way up—chandeliers sprouting from the floor and chairs and tables hanging from the ceiling? The reason is that from earliest infancy we have learned to interpret the upside down images as being upright.

Here is a little experiment to convince yourself that the retinal images are really upside down. Hold a pencil a few inches from a piece of paper lying on your desk so that a lamp casts a shadow of the pencil on the paper. If you now hold a reading glass just below the pencil, the lens cannot reverse or otherwise change the shadow because the pencil is too close to it.

Now do the same thing, using your eye in place of the reading glass: Stick a hole in a card with a pin, holding the perforated card about half an inch in front of one eye, and look at a bright surface such as a lighted lampshade or the sky. Grasping the pin by its point, hold it between card and eye and move its head upward in front of the hole. What you see is a shadow picture of the pin moving *downward* across the hole. We know from the reading glass experiment that the shadow on the retina is right side up; your brain, however, interprets it as being upside down!—*Science Illustrated.*

Acetate vs. Nitrate Issue Revived

THE immediate general replacement of nitrate film by acetate stock in the professional motion picture field has suddenly become a topic of "burning" interest to the Motion Picture Theatre Owners of America, according to a statement by President Ed Kuykendall in the current MPTOA Bulletin.

Citing the extensive use of both 35-mm and 16-mm "safety" film by the Armed Forces during the past four years, the exhibitor leader paints a glowing picture of the benefits that would accrue to the industry—production, distribution and exhibition—through the prompt introduction of acetate film. (The Kuykendall statement is printed in full on this page.)

Of particular interest to the projectionist craft is that portion of the statement which, hedged about by considerable wordage, is widely regarded as the real target of the MPTOA. Witness:

"The argument for an extra projectionist (who has nothing to do) as a 'full safety crew' vanishes into thin air with the use of non-flammable film." Thus is the cat let out of the exhibitor bag.

Parenthetically, current industry rumor has it that acetate film topic was suggested to Eric Johnston, new producer association president, as a "hot" angle that would insure a "good press." Whatever, if any, basis in fact exists for this report, the "angle" served Mr. Kuydendall very well indeed, since his release scored heavily in terms of lineage in the trade and general press.

Incidentally, not a single trade paper essayed the task of examining carefully and commenting upon the merit or lack of it of the Kuydendall proposal, thus the industry was left high and dry for a means of evaluation. I. P. purposes that its readers shall not be left in this position.

Extremely interesting is the statement issued by Eastman Kodak Company relative to the comparative merits of nitrate and acetate film. This statement by one of the world's foremost research organizations—which, incidentally, assuredly views the matter with strict objectivity since they make both types of stock—is in sharp conflict with the Kuykendall premise. (See Eastman statement herein.)

Considering the MPTOA contentions seriatum: true, the Armed Forces did use enormous quantities of acetate film, both 35-mm and 16-mm, during the war, much of which was devoted to regular theatre projection in cantonments. It is also true that acetate stock requires no change in either projectors or cameras. But these facts do not sustain the Kuykendall view anent the cheapness, durability and efficiency of the acetate base.

Acetate film has inferior mechanical properties as compared with the nitrate base. Eastman points out that the Army and Navy acetate prints were satisfactory "*under the conditions under which they were used*," being subjected to "considerably shorter" runs than are normal nitrate release prints. The substitution of acetate film at this time, continues Eastman, would "inevitably result in *substantially increased print damage* and *much higher costs* to the industry." (Italics ours.)

No improvement has been made in acetate stock in recent years which would enable it to equal the projection performance of nitrate prints. By the use of special cellulose derivatives, such as mixed esters with certain solvent combinations, the mechanical properties of the resultant acetate base would be improved to a point where it would *approach* the *production* performance of nitrate film.

However, competent authorities rate the *projection* performance of even this *improved* acetate at about 60% of that

(*Continued on page* 27)

Acetate Film Now, Demands MPTOA Head

Statement by Ed Kuykendall, President of MPTOA, in recent Bulletin

WOULDN'T this be a good time for the industry to swing over to acetate cellulose or non-flammable film? I am told tremendous quantities of this film, both 16-mm and 35-mm, were made and used extensively during the war by the Army and Navy. It is now just as cheap, durable and quite as efficient as the flammable nitro-cellulose film now used in theatres, and requires no change in projectors or cameras. And you can't burn it with a match. It reduces the fire hazard of film to an exact zero.

We are about to embark on a great theatre-building program, replacing obsolete theatres with new, modern structures and building many additional theatres. Millions of dollars can be saved, better theatres can be designed, shorter throw between projector and screen to give a better picture with less light can be provided, if we do not have to build heavy fireproof projection booths, which are required solely because we use flammable film. The argument for an extra projectionist (who has nothing to do) as a "full safety crew" vanishes into thin air with the use of non-flammable film.

And the distributors will save plenty, too. In addition to removing the risk to life and limb of employes handling film, there would be no more need for expensive fireproof film vaults, elaborate sprinkler systems, or the heavy steel shipping cases required by the I.C.C. for flammable film.

Now would seem to be an opportune time to start using acetate film on all prints; then in a year or so the inflammable ones will be out of circulation, so that the industry can make a continuous saving of millions of dollars every year in its operating expenses. Maybe by then we will need the economy.

Eastman Position Anent Acetate Film

IN VIEW of the numerous, and sometimes inaccurate, articles which have recently appeared on the subject of Safety motion picture film, the Eastman Kodak Co. has authorized the following statement covering their own position:

Following years of research and development, the quality of motion picture Safety film, particularly with respect to its ability to stand up under theatre projection, has constantly improved. The Eastman 35-mm Safety film used in large quantities by all governmental agencies during the war performed satisfactorily under the conditions under which it was used. This included regular theatre projection but, generally speaking, the length of run to which these prints were subjected was considerably shorter than that for normal nitrate prints.

Numerous tests of Safety film, both standard and experimental, have been made by Eastman in recent years in their own laboratories and under trade conditions. Such tests will continue. So far, however, both laboratory and trade tests have shown that the best Safety film is not equal in wearing quality to nitrate. Any attempt to generally replace nitrate film with the present Safety would inevitably result in substantially increased print damage and much higher print costs to the industry.

No experience to date has indicated that Safety base can be produced as cheaply as nitrate. When and if a completely satisfactory Safety base can be made and sold in quantities comparable to the present output of nitrate, the price might be lower than the present 1.25-cent price of current Safety positive, but there is no present prospect that it could reach the low price level of nitrate film.

The outlook for the eventual transition of the industry to Safety film continues to be hopeful. Improvements, however, are still essential and certainly no specific date for a possible shift to Safety base can be set at this time.

BASIC DESIGN DETERMINES PROJECTOR PERFORMANCE

By *ARTHUR E. MEYER*

MANAGER, PROJECTION EQUIPMENT DIV., NATIONAL-SIMPLEX-BLUDWORTH, INC.

ALTHOUGH it is the principal business of the projectionist to produce the best screen image he can with the equipment provided, it often is also his business to advise the manager on technical matters. In many theatres projectionists are asked for their advice both as to repair and replacement. One reason for this common practice is that the manager knows his own limitations when it comes to technology. But another is that it is always poor business to ask any expert to operate equipment he doesn't approve of. Intelligent executives often feel that if they do that, they can't expect top-notch cooperation.

Once the projectionist's advice is asked, however, he is on the spot—whether he answers or doesn't. If he refuses to advise, he can't complain of the machinery given him; if he does advise and is given the equipment or repairs he asks for, then he has no excuse if results aren't good.

The writer will try to touch on a few of the principles that should be considered in the selection of a projector mechanism, using the mechanism he knows best, the Simplex E-7, by way of illustration; but the same principles apply in the case of any projector.

One of these principles is that the mechanism should be easy to operate, not one that takes up a great deal of the projectionist's time. What every projectionist knows (and many managers never seem to learn) is the great amount of work to be done in the projection room. Film must be rewound and sometimes patched; lamphouses must be cleaned and trimmed; the screen should be under observation at all times; sound must be supervised, and a number of additional items compete for time and attention.

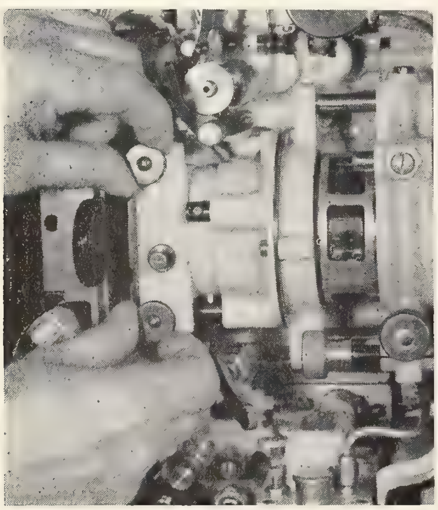


FIGURE 1

Threading, cleaning, lubricating, adjusting and other routine requirements should be simple by the very nature of the fundamental design of the equipment, so that the projectionist need not give too much time and attention to the mere routines of operation.

Threading, for example, should be facilitated by physical disposition and spacing of the operating parts for maximum convenience, in addition to the provision of a threading lamp and a white or light-colored film compartment, so that embarrassing errors may be avoided without requiring the projectionists to quadruple-check every step of the simple process of threading.

Maintaining cleanliness is one of the important routine details. There are a number of different ways of designing a projector to facilitate cleaning it. The methods used in the Simplex E-7 are illustrated in part in Figs. 1 and 2. In Fig. 1 is shown how readily the gate is removed for cleaning. Take off two knurled thumbscrews and the gate pulls right out.

Figure 2 shows the gate out and the trap in process of being removed for cleaning. Observe a small, dark machine screw resting in a loose position at the extreme top left of the trap. This screw and one other like it (a bit further down, hidden behind the thumb in Fig. 2) must be loosened with a screwdriver —and that is all.

No matter how little time there may be between reels, it still is always possible to clean the gate, and the trap also, as thoroughly as may be necessary, since both can be removed and replaced almost in no time flat.

Lubricating Requisites

Not even a hand nut need be removed to dismount the E-7's sight box for cleaning. Simply open the door of the projector and draw the sight box out. Additionally, the lubricating system of the E-7 is such that there is less cleaning to do. It isn't necessary to clear the lens surfaces of oil—oil doesn't get on them. It doesn't get on the film. This will be discussed under lubrication.

Not only should a good mechanism require little time for routine cleaning;

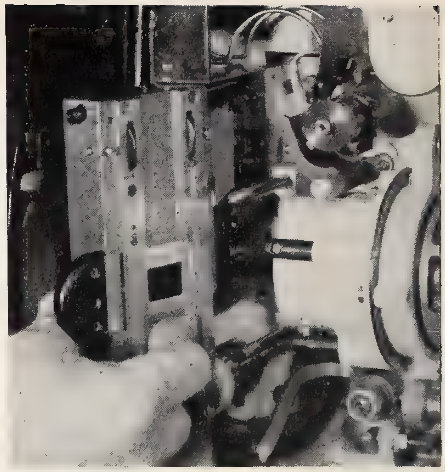


FIGURE 2

it should need little time for ordinary lubrication. If the lubrication system is such that oil is not spattered about the film compartment, not whirled here and there by revolving sprockets and shafts, cannot get on lens and film, so much the better. If the system is error-proof, avoiding any possibility that one oil hole may be overlooked and another oiled twice, best of all.

The projection room engenders distractions. Sound level needs adjusting, the arc isn't feeding right, the manager is on the telephone, a tube is acting up, and by the time the man with the oilcan gets back to what he was doing, he can very pardonably be confused as to how many drops he put in which oil hole. So some bearings may run dry, and others can drip excess oil around where it can soil the film. Suitable protections can and should be built into the projector.

Figure 3 illustrates the form of protection built into the E-7. To lubricate *every* point that needs daily attention, press down on the oil reservoir lever as illustrated in that picture. Press once or a few times, as necessary, until the lever comes back slowly instead of springing back. That's all. Lubrication is accomplished. And every bearing has fresh, unused oil, with all its lubricating qualities intact in the exact amount required.

To understand what happens, look first at the thin, curving copper tube that rises from the right-hand side of the oil reservoir. When the lever is pressed, oil is pumped through the tubing, *not* when the lever goes down but when the spring pushes it back up. That is why it should be pumped a very few times until it rises slowly, an indication that there is enough back-pressure in the tubing to assure satisfactory lubrication at every point.

Since the system is completely enclosed, oil does not get into the film compartment. It is contained within the reservoir and the tubing. When it reaches

a bearing it is forced, under 30 lbs. per sq. inch pressure, first through a filter, then through an aperture carefully proportioned for the exact amount of oil that particular bearing needs. Still under pressure, it flushes through the bearing, not only lubricating but washing, carrying away with it any dirt or products of friction that may be present. It finally washes out of the bearing at the non-operating side of the mechanism, where it can neither soil film nor lenses, nor do any other harm.

With this system the projectionist merely presses the lubricating lever once for every two hours of operation while the projector is very new; once for every four hours after it has been broken in. This means in most theatres once a day, since if the total show time is eight hours of actual projector operation, each projector has done only four hours work. Some daily adjustments may be unavoidable. Mechanical design should be such as to make them as simple as possible, as easily, quickly and accurately completed as possible.

For example, film stock sometimes varies in thickness, thus film pad tension may need re-setting. As every projectionist knows, if it is too tight for the film, he may get a blank screen because the film tears; if it be too loose, the image will not be steady and perhaps not sharply in focus. Look again at Fig. 1. Note on the gate the round nut and locknut midway between the two gate-mounting knurled thumbscrews. By means of this nut and locknut, pad tension can be re-set and re-locked while the show is running.

The foregoing is typical of the kind of simple adjustments by which the designer of a mechanism can set the projectionist free for his other show-time duties. Space here does not permit detailed description and illustration of a number of other, equally quick and ready arrangements in the Simplex E-7; for example, clearing travel ghost, should any ever appear, is only a matter of loosening a perfectly accessible, unobstructed locking screw, manipulating a control knob with an eye on the screen, and re-tightening the screw.

Steadiness and Sharpness

There are two demands from the manager that no good mechanism should impose on any projectionist, namely, that he steady a picture which can't be steadied, and that he sharpen a focus that can't be sharpened.

If a mechanism is so made that it inherently develops increasing vibration as it grows older, there really isn't much to be done about it short of returning it to the factory for rebuilding. The screen image just won't be steady, and no managerial "beef" is going to help. Every mechanism wears with time, of course, but adequate design will minimize the possibility of increasing vibration with passage of time.

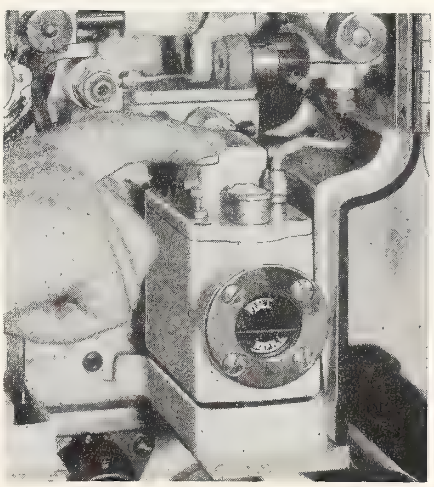
As long as there is an intermittent movement there will be vibration. But it can be reduced. Vibration not due to the intermittent can be fairly well eliminated, not merely while the mechanism is new but throughout its life. Intermittent vibration is reduced by very exact construction, by precise clearances. In the Simplex E-7 important use is also made of the principle of minimum weight in the moving parts of the intermittent. This in turn requires the most careful choice of materials in order to obtain maximum toughness and endurance with a minimum of weight.

Residual intermittent vibration is essentially isolated. The intermediate gear of the E-7 is of shock-proof construction. A broad annular ring of resilient, tough material separates its hub and rim, and cushions all the rest of the gear train against vibration coming from the movement.

As to vibration not due to the movement, a prime source of this trouble and one that grows worse as the machine becomes older, is the development of high spots in the gear train. All gears must wear, but a good projector should include provisions against high spots. The provision built into the E-7 is hunting-tooth gearing. If at the first revolution, tooth 1 on gear A meshes with tooth 1 on gear B, then 1A the next time around will mesh with tooth 2B, and the following revolution with 3B and so on, eventually meeting tooth 1B again. High spots and vibration due to high spots can never appear.

Just as adequate precautions against undue vibration protect the projectionist against incurable unsteadiness in the screen image, so suitable and effective provisions should be included in the projector to prevent incurably poor focus. The projectionist cannot produce a sharply focused picture if the heat of the light source is buckling the film or causing the frame in the aperture to "breathe" (expand) excessively. The mechanism should have an efficient cooling system.

FIGURE 3



Provisions incorporated in the E-7 for this purpose include the instantly removable sight box previously mentioned, which takes considerable heat out of the light beam before the light reaches the aperture. The sight box, in turn, must itself be cooled: this is arranged for by welding suitably shaped vanes on the blades of the rear shutter. Large volumes of air are drawn backward over the sight box toward the shutter. (Air is not blown into the film compartment, as it might carry in dust and carbon particles.)

These provisions effectively reduce breathing and the possibility of permanent buckling, and materially increase in the sharpness of the screen image.

Basic Design Summary

Projectionists, who know what a very complex piece of machinery a mechanism is, will not imagine that the few details mentioned herein cover all the essentials that properly belong in the design of a modern projector even with respect to good operation alone, apart from the question of durability.

In general, however, the projector should be designed and built to make the maximum quality of screen picture not merely theoretically possible but practicable under everyday routine projection room conditions which compel the men in that room to do many other things beside looking after the projector.

If it be properly designed and built, the mechanism will easily be kept clean; places that should not have any lubricating oil will stay free of it and not have to have oil cleaned away from them; the lubricating system will be positive, error-proof and distraction-proof; there will be an effective cooling system; necessary routine adjustments will be easily and very quickly effected; vibration will be permanently minimized, both in and out of the movement, and unavoidable residues of intermittent vibration will be isolated from the rest of the mechanism.

If originally excellent screen results are to be maintained throughout the useful life of the projector, it must meet still another set of vital requirements, some of which will be discussed in a future article dealing with projector maintenance. Obviously, a really good mechanism must do more than merely give fine screen results while it is new. It must keep on giving them. It must be "built today for tomorrow" as well as for today.

IN THE SPOTLIGHT

By *HARRY SHERMAN*

WILL history repeat itself? Let us not forget what happened after World War I. During that war labor enjoyed a favorable position in the war economy and received the recognition it had struggled so long to attain. Labor was promised many rewards as soon as the war was over and many union leaders believed that at long last the fruits of their bitter struggles were in sight. With the ending of the war, however, bedlam broke loose. The war industries shut down and millions of workers lost their jobs, many of them being stranded in former war production centers. Returning servicemen found no employment and competition for jobs became keen and bitter. With a glutted labor market came the slashing of wages. Union-hating employers and their anti-union political stooges began a vicious campaign against organized labor. The promises made labor during the war were soon forgotten and many of its hard-earned gains were erased.

From out of nowhere the "American Plan" appeared on the scene. Openly anti-union and advocating an open shop, this plan found favor with many employers who broke their union contracts and shut down their plants, with the result that lockouts spread throughout the entire country. Wages and working conditions reached their lowest level, and organized labor's fight for existence became a long and bitter struggle. These conditions ran their course and the labor movement made a strong comeback, eventually winning back its former high level of wages and working conditions.

No, history need not repeat itself and labor's experiences after the first World War must not be a pattern for today's strife!

● Within the past two months we lost two I. A. union officials—victims of heart attacks. Romeo Marcil, secretary-treasurer of Local No. 95, Ottawa, Canada, and Thomas T. Anglin, secretary-treasurer of Local No. 230, Denver, Colo., both of whom died suddenly from this dread malady.

Marcil was one of the real old-timers of the I. A., having been a member of his local for 42 years and an officer for 39 years. He was held in high esteem by his fellow workers and his passing saddened his many friends in the Alliance. The sudden death of Anglin, who was in his early forties, came as a shock to the industry. He too, had many friends in projection circles throughout the country and the news of his death evoked much sympathy for his surviving widow and daughter.

● We were sorry to learn that J. Rodger McKelvey, member of Pittsburgh Local No. 171 and editor of a local union newspaper, recently underwent an operation on one of his eyes. Rodger is a pretty tough guy to lick and it will take more than an eye operation to get him down. Here's hoping all's well again.

● When Arthur Martens, president of Westchester County Local No. 650 and Allen J. Smith, former chief of the Theatrical Division of the WPB and now with National-Simplex-Bludworth, met in the offices of M. D. O'Brien, assistant supervisor of projection for Loews', Inc., they were unaware of the fact that they were shipmates aboard the same battleship in World War I. The discovery which was made after an exchange of reminiscences of their respective experiences in the first World War called for a celebration, and, needless to say, Messrs. Martens and Smith, will long remember the occasion.

● Re-elected to office for 22 consecutive years is the record piled up by Eddie Miller, business agent of Houston Local No. 279. Grandpa Ed keeps on rollin' along—although he is a grandpappy twice over he still manages to retain that youthful appearance. Right living must be the answer, eh?

● Perhaps it is the trend of the times, but we couldn't help wondering about the defeat of many old line officials at the recent local union elections held in various parts of the country. For instance, Jimmy Burke, business agent of Boston Local No. 182 for almost 30 years; Tommy Armentrout, assistant business agent of Los Angeles Local No. 150 for the past 16 years; Sam Isaacson, business agent for Local No. 181, Baltimore, for almost a quarter of a century, and Jim Noonan of Miami Local No. 545—these men were defeated for the first time in their careers.

● Very few union meetings are conducted in quiet and orderly fashion. No doubt many of us have walked out of such meetings vowing never to attend them again, or at least not until the presiding officers had learned how to control them. We were very much interested, therefore, in an article written by James R. Forsyth, former secretary of Local No. 159, Portland, Ore., and published in a local newspaper, in which he very ably expresses his views on that particular subject.

"There is nothing, I believe, more annoying to a speaker or to the officers of an organization who are trying to conduct a meeting, "writes Forsyth, "than to have one or more members engage in an impromptu discussion in some part of the hall. Irksome irritations of this sort usually occur during important moments in the proceedings—important in matters of legality and ultimate consequence. . . .

"I recently sat in on a meeting of a union while wage increases were being discussed. There was a busy buzz throughout the hall, as usual. Some wanted to listen and couldn't. Through occasional rifts in the blanket of sound one could sometimes get an idea of what was going on, but frequently we were mistaken and got wrong opinions. If any displeasure arises when the new contracts are put in effect because of conditions that they contain, they who talked out of turn will have only themselves to blame. But will they blame themselves? They will not!"

● Our very good friend C. E. (Red) Rupard was recently elected business agent of Dallas Local No. 249. Red was somewhat lax in sending this department the entire list of Local 249 officers, hence the absence of the local's listing in our I. A. Elections columns. Rupard and yours truly have attended many I. A. Conventions together and have split

many a bottle of Coca Cola. Well, good luck, and here's hoping we meet at the next convention, four months hence.

● Stewart Seifert, of Local No. 223, Easton, Penna., is secretary of the Central Labor Union of Easton and vicinity, and also of the Easton Trades Union Club. Executive officers of the club must be accredited CLU delegates. Stewart is very proud of the Trades Union Club and informs us that plans are now being drawn to erect an office building on property belonging to the club. The second and third floors of this proposed building will be devoted to club rooms and an auditorium, and the front offices of the upper four floors will be leased as offices for other unions. According to plans, the front and rear of the building will be of polished concrete, with the side walls of reinforced concrete. To sum it up, the Trades Union Club has outlined a very ambitious program and we wish them loads of luck.

● We received a newsy and interesting letter from Fred J. Loakes, supervisor of projection and process for the Walt Disney Studios in Hollywood, in which he mentions a visit he received from C. W. (Pat) Offer, former business agent for Hollywood Local No. 165, and Pat's brother Nate, charter member of Salt Lake City Local No. 250. Loakes, who is a member of Local No. 150 (Los Angeles) and Local No. 165, got quite a kick showing the Offer brothers around the studio. He showed them how the animators bring to life the imaginary characters and put them through their paces, how the cells are inked and painted and then finally photographed on the huge Multi-plane camera. "It was a pleasure," writes Fred, "to show Nate and Pat around the studio, and I wish all of you could see the wonders of making make-believe pictures with actors who do not exist."

Incidentally, Fred informs us that Nate Offer began his career as a projectionist way back in the dark days of 1909, later quitting the film game to go into the candy business (a sweet business). Pat Offer is no stranger to the readers of I. P., his excellent work as business agent for Local 165 having gained for him the high regard not only of the members of his local but of everybody in the industry. He fought hard and long for better working conditions and wages for his men, and also insisted that they, in turn, give better service to their employers. After a much needed vacation, Pat will go to work for RKO pictures.

"After an extended program of training film for the armed forces," continues Fred, "we are now back in the entertainment field and will be making live-action pictures, as well as cartoons, our latest being 'Uncle Remus,' part cartoon, part live-action."

You have aroused our curiosity and whetted our appetite, friend Fred, and we shall make it our business to have you guide us through the Disney studios, if and when we next visit Hollywood. Is it a date?

● Dave Siegel, member of Toronto Local No. 173 and a former president, was elected president of the Toronto Motion Picture Social Club. Leon Charlip, also a member of Local 173, was elected social convener.

● Several issues ago we printed an item in these columns about the Texas AMVETS, an organization of American Veterans of World War II, wherein we mentioned the support given this group by Karl Hoblitzelle, president of the Interstate Circuit of Texas. A letter from Mr. Hoblitzelle explaining his position in the matter and the nature of his financial assistance to the Texas AMVETS follows:

Dear Harry:

I certainly was surprised to see the story under your name in the December "Projectionist" wherein you used my name and the name of our company roughly and unfairly. If you want the real facts of the matter, here they are.

In the latter part of June of last year, just a day or so before I left for Mexico where, incidentally, I spent the entire summer, I was approached by some officials of the then embryonic Texas AMVET organization. The organization had been mentioned frequently in the press and, in so far as I could tell, favorably. They indicated that they needed some financial help to get started and to publish a small monthly magazine.

I did agree to aid them on a very modest basis for a period of three months. I then left for Mexico City, and forgot about the whole matter. My only feeling and objective was to assist a young, struggling, patriotic veterans organization to get underway.

You might be interested in this statement by the public relations officer of the local AMVET organization, pertaining to the story which you picked up and apparently amplified: "The charge of Todd that the Texas AMVET, State Organ, is controlled by Texas capitalists is false. The Texas AMVETS is an organization of, and run by, veterans of World War II."

So far as I know, there has been nothing but the finest relationship between our company and its union personnel. I regret that you saw fit to pick up a wild-cat story of this kind and print it.

With best wishes, I am,

Yours sincerely,
KARL HOBLITZELLE.

While we are happy to publish Mr. Hoblitzelle's side of the story and believe that whatever financial assistance he rendered this group was given in a spirit of generosity, we do take exception to his reference to our picking up and printing what he terms a "wild-cat" story. This story appeared in many reputable labor periodicals throughout the country and was broadcast over radio station, KTBC, Austin, Texas.

It is a well known fact that many of these "patriotic" organizations are but tools in the hands of unscrupulous labor-baiting factions in this country who do not hesitate to use these groups to "pull their chestnuts out of the fire."

Los Angeles Local No. 150 Reports:

● A contract with the Embro Company for 16-mm operation was recently negotiated, calling for a wage scale of $88.50, with a maximum of 12 shows per week. Projectionists working outside the jurisdiction of Local 150 will receive the established road scale set by the I. A. and will work under an International

(Continued on page 34)

Fred Loakes (center) and the Offer brothers, Nate (left) and Pat (right) smiling for the "birdie" at the Walt Disney studios.

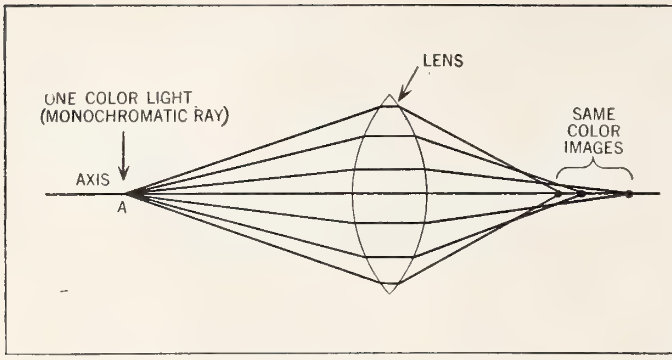


FIGURE 3. *In spherical aberration, rays of the same color impinging on the lens at different distances make it impossible to sharply focus A.*

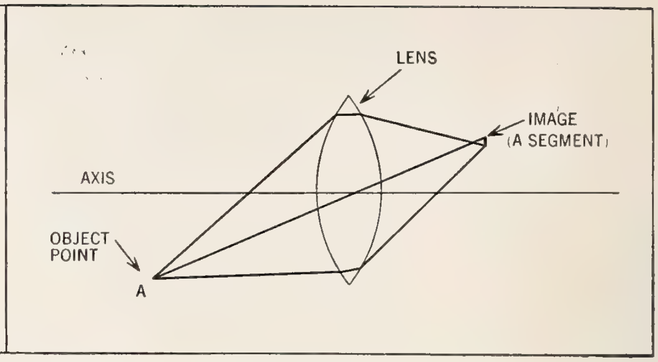


FIGURE 4. *If the object point A is moved away from the optical axis, though remaining in the same plane, another aberration, coma, results.*

Projection Lens Aberrations

By *ANGELO MONTANI*
CONSULTING ENGINEER, NEW YORK CITY

The science of computing lenses for various purposes is a complicated one with which few are familiar. Lens aberrations or faults are many and must be carefully corrected. Here are shown a few of the more common forms of aberrations with which lens designers are concerned, as originally set forth in "Electronic Industries." Illustrations have been simplified to help in giving an understanding of the principles involved, faults being shown qualitatively and not quantitatively. Also, while aberrations are invariably co-existent, they have not been so shown in this presentation for the sake of clarity.

IN simple English, "aberration" means defect or deviation from a normal behavior. It is with this last meaning that the term "aberration" is conventionally used in optics, astronomy and psychiatry. Every lens, convex or concave, has a definite focal length f which is expressed by the relation:

$$\frac{1}{f} = (n-1)\left[\frac{1}{r_1} - \frac{1}{r_2} + \frac{t}{n}\,\frac{n-1}{r_1 r_2}\right]$$

In this equation n is the index of refraction of the glass; r_1 and r_2 the radii of curvature of the two surfaces, and t is the axial thickness of the lens. Fig. 1 shows the physical meaning of f and related parameters. The distance between P and O is the local length f.

The construction on the figure clearly shows how the location of P is determined. If we now should trace some other ray impinging on the lens above or below the one represented, we would find after the ray is refracted, different locations for points P and O. Besides, if the color of the ray be varied, we would find still newer locations of points P and O.

Therefore to give an exact meaning to the foregoing algebraic relation it has been arranged so that it applies only to rays impinging on the lens parallel to the optical axis, and so near to it that they cannot be distinguished from one another. The selected color of such rays is the yellow of the n_d spectral line. Under these conventions, the formula yields a definite focal length. All those rays which do not behave according to the equation deviate from the rule and constitute aberrations.

Principal Aberrations

We consider here six principal aberrations, and at each instance, for the sake of clarity, only one aberration is considered at a time. In reality, of course, all aberrations exist at the same time and mutually interfere. The easiest aberration to grasp is the chromatic aberration or color dispersion. Every schoolboy knows that a prism will decompose a ray of white light into its elementary colors.

Figure 2 shows how a lens may be thought of as two prisms with spherical surfaces joined together. The logical necessity that a lens should also decompose the white light immediately follows. Since no unique focus can be obtained, it is impossible to secure a sharp image of point A. It is understood that in the present figures only few characteristic rays are traced and the aberrations are represented qualitatively and not quantitatively.

Figure 3 illustrates spherical aberration. We see how rays of the same color, but impinging on the lens at different distances from the optical axis, form different focii. The rays passing through the lens near the edge form the shortest focus. In this case also, it is impossible to obtain a sharp image of point A.

So far we have considered point A situated on the optical axis; let us move it away from the latter although remaining always on the same plane. Beside the aforementioned aberrations, new aberrations arise in this new position. One of these is "coma." The image of point A is no longer a point, but a short segment, as in Fig. 4. If now point A be raised above the plane, we get also "astigmatism" or "astigmatic aberration."

A tri-dimensional representation of the phenomenon is necessary to visualize it. Fig. 5 shows how the dashed rays emanating from point A form equal angles with the surfaces of the lens, and after refraction, form a separate focus from the dot and dash rays forming non-equal angles with the lens surfaces. The two

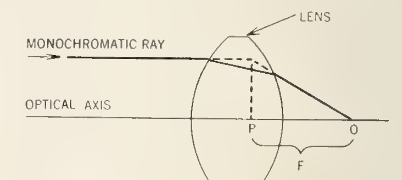


FIGURE 1

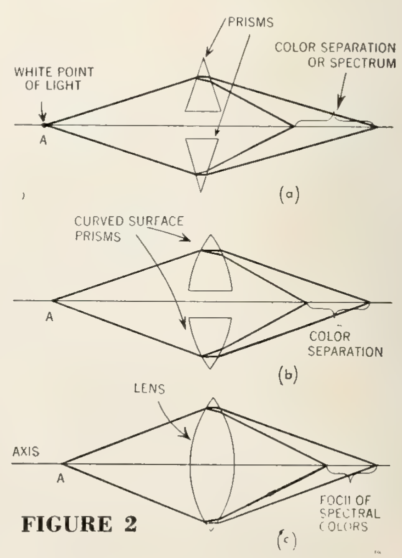


FIGURE 2

FIGURE 1. ***(Top)*** ***Physical meaning of the term f and related parameters.***
FIGURE 2. ***Analogy between two prisms and a spherical lens showing how point source is focused.***

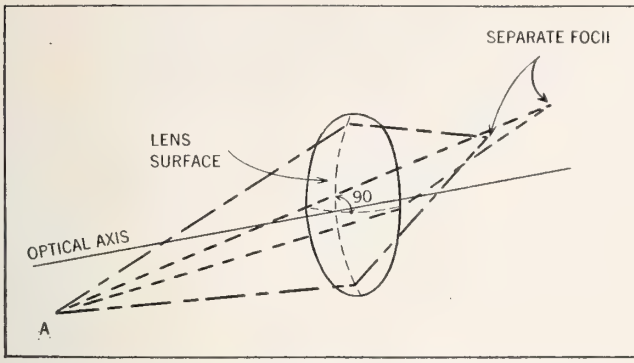


FIGURE 5. *Tri-dimensional representation of the phenomenon of coma showing the manner in which rays impinging on the lens are refracted.*

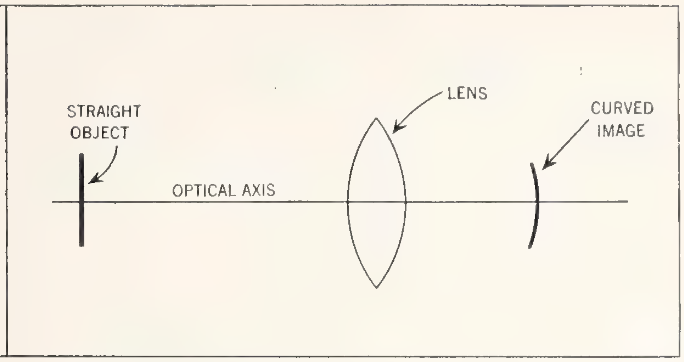


FIGURE 6. *If instead of a point source of light a line image is used, the resultant image will be curved in conformity with lens concavity.*

couples of rays lie on perpendicular planes.

If instead of a point we try now to obtain the image of a line, then we discover "curvature of field." Fig. 6 shows how the image of a straight line would be curved with the concavity facing the lens. Only on an appropriately curved screen could this image be focused all at one time. Fig. 7 shows the last aberration considered here, which is simply called "distortion." Distortion in fact is evident in the metrical property of the image in relation to the shape of the object.

We again repeat, all of these aberrations exist at the same time. Separate figures were used for each one because should we have represented all of the aberrations together, the figure would have looked almost undecipherable.

Although we are confining ourselves here to the mere description of aberrations, we feel that it is legitimate to expect from the reader the spontaneous question: If a lens is really so defective, how is it possible that we us them?

In our very short excursion into the dioptrical domain we did not mention at all the "negative" lenses, but only the positive ones. Fig. 8 shows the negative lens with concave surfaces which was not described because it does not form images that can be focused on a screen.

This type of lens presents the same aberrations as the positive lens but of opposite sense, and therefore it is used in conjunction with the lenses illustrated previously for the purpose of reducing and correcting their faults. Concurrent artifices to the lens correction are the proper shaping of the surfaces, choosing of the types of optical glass, spacing of the surfaces, axial thicknesses, etc. This proceeding, that sometimes is extremely complicated and requires years of work, constitutes what is called "lens computing."

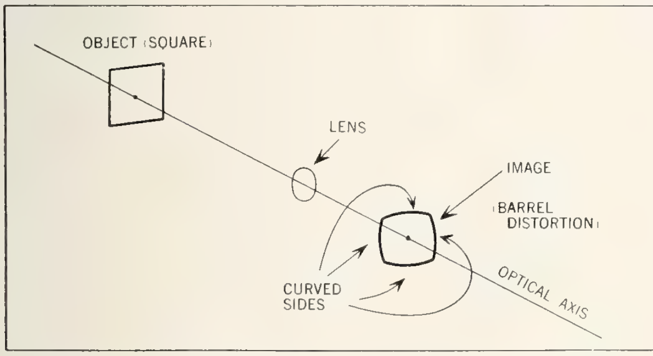


FIGURE 7. *Another form of lens aberration for which corrections must be computed is distortion, in which the shape of the object becomes altered.*

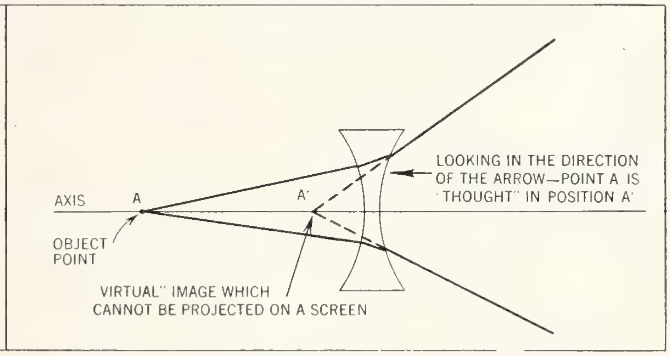


FIGURE 8. *Concave lenses are subject to the same aberrations as convex lenses, are computed to be used in reducing and correcting lens faults.*

RCA VICTOR ANNOUNCES NEW 16MM PROJECTOR

The 16-mm equipment section of the RCA Victor Division, Radio Corporation of America, announces a new and improved 16-mm film projector which incorporates many wartime technical advances. Initial units are now coming off the production lines and limited deliveries to dealers already have started.

The new projector is hailed by those associated with its development as an achievement in combining professional performance with rugged construction and simple, foolproof operation. The new projector, RCA Model 201, was designed primarily to provide schools and colleges, churches, industry, commercial establishments, civic groups and similar organizations with the highest quality of projection and sound reproduction.

Equipped with a 20-watt studio amplifier the new model features the famous RCA Sound Stabilizer, RCA's new friction drive even tension take-up, and a completely removable film gate which permits easy, instantaneous cleaning of the aperture.

TWO AWARDS TO DEVRY FOR TECHNICAL ACHIEVEMENT

Two signal honors were accorded the DeVry Corp. during the past month. First was awarded a Certificate of Service by the Army Air Force for meritorious assistance in the ground training program of that organization. The DeVry contribution included not only movies for training, briefing and entertainment but also several heretofore secret devices, including the Panoramic Gunnery Trainer for instructing aerial and anti-aircraft gunners. This amazing machine enabled gunners to 'shoot "electronic bullets" at motion pictures of actual enemy planes.

The other DeVry award was a Certificate of Merit from the New York Museum of Science and Industry in recognition of outstanding achievement in the development of equipment for training and entertaining Army and Navy personnel. This marked the first time the Museum award went to a motion picture company. The DeVry Corp. also won the Army-Navy E five times.

EIGHT NEW DRIVE-INS FOR THE MIDDLE WEST

The Cleveland regional office of the RCA Victor Division, Radio Corporation of America, announces the sale of complete RCA projection and sound systems for eight new drive-in theatres to be constructed by Herbert J. Ochs, a pioneer in this type of operation. Thomas F. McCleary, RCA's Cleveland-Detroit representative, who concluded the sale stated that all eight theatres will us the newly designed RCA In-Car speakers.

Basic Radio and Television Course

By *M. BERINSKY, E.E.*
MEMBER, INSTITUTE OF RADIO ENGINEERS

XX—TRANSMITTERS

THE vacuum tube assumes many shapes and sizes. Ordinary tubes vary in the number of their pin connections (prongs). Some tubes have as many as eight prongs, while others have as few as four. The diameter of the tube bases used also varies widely. Fig. 1-A shows a 4-prong tube socket, and it may be seen that two of the prongs are of greater diameter than the others. The larger prongs are for the filament connections. The other prongs represent the grid and plate connections.

In order to follow a wiring diagram it was necessary to standardize on a tube base numbering system. In the U. S. A., the Radio Manufacturers' Association (R.M.A.) has introduced such a system for most tube types. In Fig. 1-A the large pin to the left is designated 1; with the other pins being designated 2, 3 and 4, in clockwise fashion. To find the exact elements represented by each number for a specific tube one need only refer to a tube manual such as those published by RCA or Sylvania, which are available at any large radio supply house.

The 5-prong tube must necessarily have a different socket and pin-numbering system than does the 4-prong tube. Fig. 1-B shows the connections for a 5-prong tube. It will be seen that pins 1 and 5 are closer together than are pins 2, 3, and 4. Pins 1 and 5 represent the filament or heater connections. The numbering system begins with the left-hand side of the filament connection.

In order to facilitate finding pins 1 and 5, a small hole is sometimes punched into the wafer socket between them. For the same reason, an arrow is sometimes drawn on the bakelite tube base. All pins are of equal size on the 5-pin socket.

The 6-pin socket is shown in Fig. 1-C, wherein two prongs are of larger diameter than the others. These prongs represent the filament or heater connections. The numbering system in this type socket, as in all the others, progresses in clockwise fashion.

The 7-prong socket shown in Fig. 1-D contains two prongs of large diameter for the filament or heater connections, and five smaller prongs for the other tube elements.

The socket shown in Fig. 1-E is known as the octal-base socket, having eight pins of equal diameter, in addition to a self-aligning key on the tube base. A slot in the socket is used in conjunction with this key, making it impossible to insert the tube improperly in its socket. This base, first used on metal tubes, is now used also on the newer glass tubes.

Octal-base tubes are the most commonly used at the present time. Pins 2 and 7 are generally the heaters, although pins 7 and 8 are used on some types. With a metal tube pin 1 is usually grounded, being generally connected to the metal shell internally. Grounding the shell causes it to act as a shield, eliminating the need for using an external tube shield.

Figure 1-F shows an 8-pin socket of the new lock-in type. The pins, of small diameter and all of equal size, issue from the tube through a special glass base. The key is of metal, as compared with the bakelite type used in the octal socket. This type base is also known as an octalox. The tube locks securely in its socket and is very difficult to insert or to remove. The numbering method is similar to that used on the octal socket, except that pins 1 and 8 represent the filament connections.

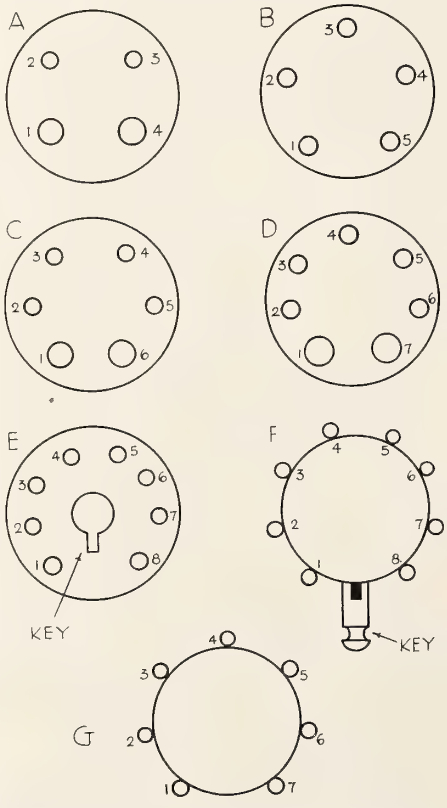


FIGURE 1. *Standard tube base connections. (a) 4 prong; (b) 5 prong; (c) 6 prong; (d) 7 prong; (e) octal; (f) lock-in (octalox); (g) 7 pin miniature.*

Tubes having lock-in bases seem to possess one undesirable feature: the pins display a tendency to corrode, causing them to make poor contact. This condition is difficult to detect because the tube appears to be securely locked in its socket. The associated circuit will not function properly under this condition. Removing the tube and cleaning the pins will eliminate trouble of this kind.

Miniature Tube Types

The popularity of portable receivers during the past six years emphasized the need for smaller tubes and led to the development of the miniature types, a socket for which is shown in Fig. 1-G. The mini tube has seven pins of very small diameter. No metal or bakelite is used on the base, which is of a special type of glass more rugged than the glass used to form the bulb. Filament connections are made to pins 1 and 7, the distance between which is greater than between any of the other pins, thus the tube cannot be inserted improperly in its socket.

The diameter of the tube is only 9/16 inch, which small base plus the fact that tube length is only a little more than an inch, makes possible the construction of very compact electronic equipment such as portable receivers, hearing aids and walkie-talkies.

These mini tubes are designed to operate with low filament current drain so as to make battery operation practical and economical. Usually some of the tube elements are tied to more than one pin internally: for example, the plate could be connected internally to pins 2 and 6—which setup helps greatly in the manufacture of compact equipment and enables the designer to use short and direct wiring layouts.

Mini tubes have several disadvantages among which are (1) the tube does not rest securely in its socket because of insufficient pressure of the contacts on the pins; (2) the pins have a tendency to corrode, as in the lock-in type of socket, and (3) the filaments cannot be operated with A. C. because excessive hum will develop due to the absence of a cathode. Where the tube is subject to excessive vibration, such as in military applications, close fitting shields which lock to the socket are provided. These

shields serve a dual purpose as shields and for holding the tube securely in place.

Mini tubes vary in height from a little more than 1 inch to approximately 3 inches. Transmitting tubes, of course, are much larger. Many of the newer tubes are duplications of existing types. For example: the 6Q7, 6Q7-G and 6Q7-GT are all similar in their electrical characteristics but differ in their physical proportions.

The 6Q7 is a metal tube; the 6Q7-G is a glass tube of ordinary size, and the 6Q7-GT is a glass tube of smaller diameter and height than the 6Q7-G. The first number in a tube type usually denotes its filament voltage: for example, the 6Q7 would have a filament voltage of approximately 6 volts. This does not always hold true, however, especially in the older types of tubes. The No. 58 tube, for instance, uses only 2.5 volts on its filament. Tubes having an octalox base generally have a first-number designation of 7, as in the No. 7H7.

A RADIO communication system comprises a generator of high frequency electro-magnetic waves and a device that can receive these waves without the benefit of wires. The high-frequency generator, together with its amplifiers and other associated equipment, is known as the "transmitter." This transmitter could, theoretically, consist of a microphone, an amplifier, and a radiator in the form of an antenna. Such a theoretical transmitter is shown in Fig. 2.

This transmitter, while theoretically possible, would not be practical. The frequencies generated by the microphone when voice and music waves strike its diaphragm would vary from approximately 40 cycles to 15 kilo-cycles. The length of an antenna should be a fixed value dependent upon the frequency of the transmitter. This is necessary if the antenna is to act as an efficient radiator. Since the frequency of this transmitter would vary widely, it would be impossible to choose a proper length of antenna.

Audio waves of the type found at the microphone are known as low frequencies. Low frequencies have very long wavelengths, determined by the formula:

$$\text{Wavelength in meters} = \frac{300.000}{\text{Frequency in kilo-cycles}}$$

The antenna is usually cut to ¼ or ½ of a wavelength, which means that the

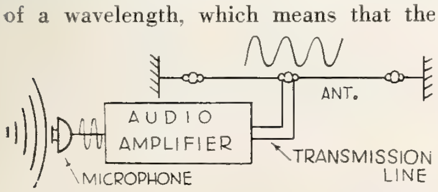


FIGURE 2. ***A theoretical transmitter.***

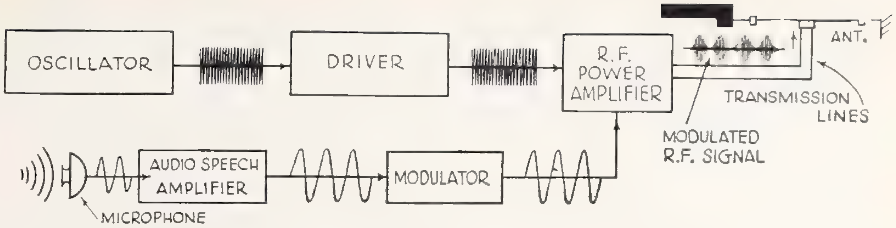


FIGURE 3. ***Block diagram of a typical phone transmitter.***

length of the antenna would be ¼ or ½ of the value found in the formula. Assuming that the average audio frequency were 5 kilo-cycles, then the wavelength would be 60,000 meters. A meter is 39.37 inches, or slightly more than one yard in length. This means that the antenna should be aproximately ¼ or ½ of 200,000 feet long. Such a length is too long to be of practical value. Other technical difficulties also present themselves, so that the set-up shown in Fig. 2 is never used.

If the frequency of an alternating current be gradually increased, there is a tendency for the current to travel along the surface of the carrier wire. This tendency is known as "skin effect."

JANUARY QUESTIONS AND CORRECT ANSWERS

1. ***(Q.) What is the function of the control grid?***

   (A.) The control grid controls the flow of electrons to the plate and makes amplification possible.

2. ***(Q.) What is the function of the screen grid?***

   (A.) The screen grid increases the efficiency of the tube and reduces its inter-electrode capacitance.

3. ***(Q.) What is the function of the suppressor grid?***

   (A.) The suppressor grid repels secondary emission electrons back to the plate, increasing the plate current and the efficiency of the tube.

If the frequency be increased, the tendency for the signal to leave the surface of the wire is increased, and the amount of radiation from the wire will also be increased. A high frequency is also desirable in order to enable the transmitter to work with an antenna of moderate length.

Generating H. F. Waves

The high frequencies used on the standard broadcast bands vary from 550 kc. to 1600 kc. High frequencies can be generated by high-speed rotating machinery, but this method of obtaining the high frequencies needed in modern radio transmission is not practical.

The vacuum tube, used in conjunction with coils, condensers, and resistors, can generate higher frequencies than is possible with rotating equipment, and the process is much more economical. A generator of this type is known as an oscillator. The purpose of the signal generated by the oscillator is to simplify the design of the transmitter and antenna circuits. The frequency of this oscillator will determine the frequency of the transmitter. This frequency will either be the same as the oscillator or some multiple of the oscillator frequency.

The signal produced by the oscillator does not contain any intelligence and is too high in frequency to be heard. In a practical transmitter the signal produced by the oscillator is amplified by several vacuum tube amplifiers the output from which is used to drive a high-powered radio frequency amplifier which, in turn, is connected to the antenna. The signal which is now on the antenna is called the carrier frequency, or simply the "carrier."

A radio telegraph transmitter need not contain any more than the aforementioned stages. When the operator manipulates the telegraph key he interrupts the signal on the antenna. A short interruption will produce a dot and a longer interruption will result in a dash. Recall that the frequency of the carrier is too high to be heard. A receiver which must receive this type of transmission (continuous waves, abbreviated C. W.) contains a special circuit, known as a beat-frequency oscillator, which changes the inadudible high frequencies to low frequencies of from 400 to 1000 cycles.

Amplitude Modulation Data

Phone transmitters must of necessity be of a more complex design than code transmitters. The code transmitter, explained briefly previously, is an integral part of the phone transmitter because it supplies the carrier frequency. In order that intelligence may be transmitted by the carrier in the form of voice and music, a method for varying the amplitude of the carrier at an audio frequency rate must be provided. The process whereby the amplitude of the carrier varies at an audio rate is known as "amplitude modulation."

A block diagram of an amplitude

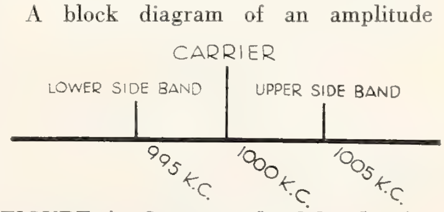


FIGURE 4. ***Carrier and sidebands of a modulated signal.***

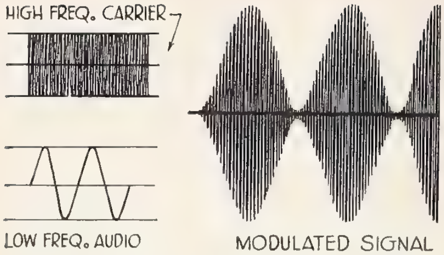


FIGURE 5. ***Components of a modulated signal.***

modulated transmitter is shown in Fig. 3. The oscillator, driver, and RF power amplifier create the carrier. The audio waves strike the diaphragm of the microphone and are converted by the microphone from a disturbance of air particles to electrical disturbances. These disturbances are amplified by the audio amplifier and are then fed into the modulator.

The modulator is a power amplifier and is similar to the amplifiers found in projection rooms. The audio power from the modulator is fed into the RF amplifier and causes the carrier amplitude to vary at an audio rate.

The modulated carrier will contain many frequency components. Suppose that a 5000-cycle note is fed into the microphone, and the carrier frequency is 1 megacycle (1,000,000 cycles). The frequencies present at the antenna will contain the carrier frequency and the sum of the carrier and the modulating frequencies and also the difference between these frequencies. The sum of the two frequencies (1,005,000 cycles) is called the "upper sideband," and the difference between these two frequencies (995,000 cycles) is known as the "lower sideband."

Figure 4 shows graphically the location of the carrier and the sidebands cited in the foregoing numerical example. The transmitted power and the intelligence appears in these sidebands. In the transmitter the audio signal causes the amplitude of the carrier to vary. Fig. 4 shows that the frequencies present in the transmitted signal are too high to be heard.

Figure 5 shows the resulting modulated wave which is created when a sine wave audio signal causes the amplitude of the carrier to vary. A trace of the peaks of the modulated wave can be seen to contain the original audio wave, although the frequencies contained in the modulated wave are too high to be heard.

The receiver contains a circuit which follows the variations on the peaks of the modulated signal. This circuit is called a "demodulator" or "detector." Since the peak variations occur in both the positive and negative directions, only one-half of the modulated signal is required in the detector. This means that the detector will also act as a rectifier.

Antennas used with modern transmitters are variations of two types known as the Hertz and Marconi antennas. The Hertz antenna is ½-wavelength or any multiple of ½-wavelength; while the Marconi antenna is ¼-wavelength or any odd multiple of ¼-wavelength. Physically, the antenna is slightly less than ½ or ¼ of a wavelength due to "end effect" (capacity from end of antenna to ground).

The Hertz antenna is better than the Marconi for long-distance transmission. The Marconi antenna is used at low radio frequencies because it is only ¼-wavelength long. A Hertz antenna would have to be twice as long at the same frequency. The Marconi antenna has low radiation efficiency and large losses to ground. A good ground is necessary with this type of antenna.

Figure 6-A shows a Hertz antenna with standing waves of voltage and current. It can be seen that the voltage is a maximum at points where the current is zero. Fig. 6-B shows a Marconi antenna with standing waves of voltage and current. One end of this antenna is grounded.

The voltage and current distribution of standing waves is seen to be similar to those appearing on one-half of the Hertz antenna. The design of the antenna is very important, and a stronger signal may be radiated from a low-powered transmitter having a good antenna than from a high-powered transmitter with a poorly designed antenna.

FEBRUARY QUESTIONS

1. **What is the purpose of the keys on the octal and octalox tube bases?**
2. **How does the length of an antenna vary with the carrier frequency of a transmitter?**
3. **Why is a modulator required in a phone transmitter?**

The answers to these questions will appear in the next issue.

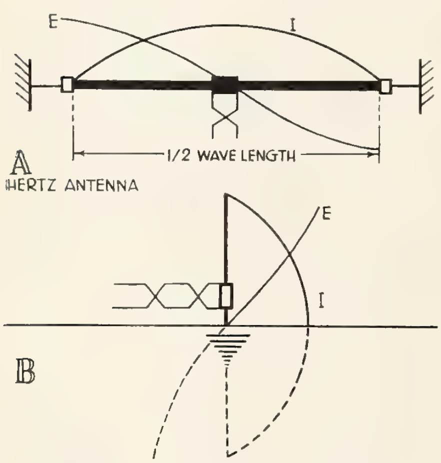


FIGURE 6. ***(a) Standing waves of voltage and current on a Hertz antenna; (b) standing waves of voltage and current on a Marconi antenna.***

Valuable Theatre Data In Books by Strong

Two important additions to the history of the theatre—one on the physical side, the other technical—have been made available by The Strong Electric Corp. of Toledo, Ohio, manufacturers of projection arc lamps, rectifiers and reflectors.

"Stages Through the Ages" details in gorgeous illustration and explanatory copy the development of the physical theatre from the time of ancient Greece down to huge multiple entertainment projects of the present. A splendid example of fine printing, this book comprises 80 pages including 38 full-page illustrations.

Art work for this volume was executed by one of the country's outstanding architectural illustrators; while the research work and the text were supervised by Harry H. Strong.

On the technical side is a book which tells the story, in beautiful illustration and text, of the step-by-step production of projection arc lamp reflectors, a leading product of The Strong Electric Corp.

Starting with the technical engineering of the gauges used to develop the molds, the book details each production step through the cutting of the blanks, grinding, forming, annealing, polishing, silvering, electroplating, backing, inspection and testing—emphasizing the painstaking care essential to producing these reflectors.

Copies of this book are distributed with each Strong reflector, but anyone may obtain a copy by addressing the manufacturer.

Showing how silver is deposited by a continuous flow of the solution on the back of the mirror so as to assure a uniform and brilliant reflector.

IP AT YOUR SERVICE

This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

Replacing Rubber Motor Cushions

Recently I found it necessary to replace rubber motor cushions on MI-1040 soundheads without a tool. This can be done with ease by lubricating the rubber cushions, the boss on the end bell and the retainer ring with linseed oil soap. A light film of the soap permits the spring to be started in the groove and tapped into place with a screw driver with less trouble than by use of the special tool. There are no hydrocarbons in the soap, therefore no softening of rubber will take place.—V. Wm. Goetz, *RCA*.

Simplified Wiring Suggested

In order to simplify the untying of plain and fancy knots in copper wire, after the knots are well covered with solder, I suggest adoption of the following as standard practice in making all soldered connections in amplifiers, etc.

With wire turned in a clockwise direction, when viewed from the open or unmounted end of terminal, and with a minimum number of turns consistent with mechanical strength, one turn is suggested.

If the terminal happens to be a closed loop, as a ground bus, let the turns be in a right-hand finger direction—as would be indicated by an imaginary grip on the bus with the right-hand thumb to the left.

During maintenance, testing and replacement in the field, these knots must be united, mostly with the tip of the soldering iron, with resultant breakage and damage to parts by heat.—Omer S. Wible, *RCA*.

Refinishing Sound Equipment

I carry around with me a small portable spray painting equipment consisting of a can of black and one of white lacquer. I also have a can of wrinkle finish enamel and four infrared lamps. With this I have been able to refinish soundheads and amplifier cabinets without moving them.—V. F. Munson, *RCA*.

Sealing Screws in Place

If for any reason you wish to seal a screw in place, just back the screw out until the threads show. Then with a soldering iron heat the screw until sealing wax will melt on the thread, after which screw it back into place. The wax should be of that kind which is used on the backs of sockets and other electrical fixtures to keep screws in place.—M. P. Deming, *RCA*.

Emergency Socket Replacement

Replacement of the socket of the W. E. 341-A tube where used in power units supplied with W. E. 5M91 systems is very often required. It has been found that the Hammurland 4-prong transmitting tube socket made of steatite is a very good replacement, having very sturdy tube prong contacts which eliminate heating and which may be installed without any drilling or machining of the power unit chassis.—D. W. McMillin, *RCA*.

Eliminating Safety Switch Click

After installation of safety controls on projection equipment which included RCA M1-9001 soundheads, there was a very audible click in the stage speakers each time the safety device operated. This noise was eliminated by shunting a .1 mfd. condenser across the switch in the soundhead.—H. M. Morrow, *RCA*.

Make Your Own Spintite Wrenches

Most engineers carry in their tool kits a set of spintites which they find very useful in their service work. At times they find a very small nut and have no spintite for that size. Here is a way you could make yourself a set of small spintites:

Secure from any hardware store a complete set of Allen set screws—it is advisable to get the longest ones possible. Take these set screws and grind down the threads on an emery wheel. This could be done on a lathe, but usually your set screws are hardened and pose a very tough job for the cutting tool, although it could be done.

After the threads are ground down, insert the set screws into a piece of hollow tubing—brass, copper, etc. This tubing will serve as a handle for the spintite. The reason why it is advisable to secure the longest screw possible is so you can insert it into the hollow tubing, and still have about an inch or even half an inch extending out from the tubing. When grinding off the threads make sure to leave enough edging so that when you apply pressure on the spintite it will not break off.

If you don't care to grind off the threads, you could tap a piece of hollow tubing and screw them in the tubing. But this will have a very large handle for the larger size and a very small handle for the smaller size. If you grind them down they will have handles about equal size. These spintites are very handy and useful for many small jobs.—A. L. Friel, *RCA*.

Phasing PM Speakers

In phasing PM speakers I found that by covering the opening with a very thin piece of paper or cellophane and applying a voltage to the voice coil or coupling transformer, the paper or cellophane would move forward or backward depending on which way the cone was moving.—Gil Knapp, *RCA*.

Drawing Accumulated Oil from Brenkert Projector Head

Where Brenkert BX-40 or BX-80 projector heads are mounted on RCA M1-1040 or 1050 soundheads with an oil drip pan underneath, a small hole drilled in the lower front cover on the operating side will allow oil seepage to drain out into the oil pan to the waste oil receptacle.—C. R. Shephard, *RCA*.

Replacing Capacitors

Replacement of defective capacitors in amplifiers having the nut fastening the capacitor to the chassis can be simplified by replacing this type with FP type and mounting the wafer on top of the chassis with self-tapping screws. Future replacements can be made without going on the underside of the chassis.—Tom Hines, *RCA*.

Servicing PB-85 Controls

In servicing PB-85 controls it is usually necessary to handle the relay coil. In doing so the outer paper wrapping over the coil may be disturbed and result in a broken lead or connection between the

fine enamel wire and the flexible lead to the terminal. By using ordinary film cement or model airplane cement at one or two points between the outer paper covering and the insulating end pieces, the twisting action and subsequent wire breakage can be avoided.—R. H. Bisbee, *RCA*.

Installing Motor Mounting Cushions

An unusual amount of trouble was experienced in installing a set of motor mounting cushions. A half dozen attempts to properly seat the wire retaining ring with a special tool did not help. It was found that by removing the rubber from the motor and trying the beveled metal retainer separately, it did not fit the motor end bill freely and would not pass the groove in which the wire ring fits.

By rotating the retainer a position was found where it would slip past the groove without binding. By using this position for the retainer when the parts were reassembled, no further trouble was encountered.—E. W. Berger, *RCA*.

Substitute Contact Switches

I recently ran into a novel arrangement to overcome the wartime shortage of momentary contact switches. This theatre had been using the wall-type push-button switch, and when one became defective and another couldn't be purchased, a single-pole, single-throw toggle switch was used instead. In order to make the contact momentary, a hole was drilled in the bakelite handle of the switch and a spring fastened so as to hold the switch in the off position. This worked very effectively. Another and easier method is to utilize automobile starter switches that can be used for either wall or floor mounting.—H. M. Morrow, *RCA*.

Improving Operation of TA-7260 Aperture

Installation of Brenkert intermittent pads X1964 on TA-7260 W.E. sound apertures in place of the E-3 film shoe will eliminate the problem of the pad turning sideways and jumping off the sprocket. This pad is a one-piece assembly and aligns up better with the sound sprocket.

The Brenkert pad is interchangeable with the pad already installed. The only additional parts required are two small washers to place in back of the springs.—H. N. Kidwell, *RCA*.

Effective Drying Agent

Infra-red lamps are ideal for drying out under chassis where amplifier heat is not sufficient in humid localities. Equipment such as motors that have been watersoaked in floods or rain can also be dried out using an infra-red lamp.—V. F. Munson, *RCA*.

ACETATE vs. NITRATE FILM

(*Continued from page* 15)

of nitrate stock. So much for the durability of acetate film.

Mr. Kuykendall's remark relative to the comparative costs of nitrate vs. acetate film has no basis in fact. All film manufacturers agree that acetate would cost *more* not less per foot—quite apart from the unanimous opinion of experts that acetate prints are much shorter-lived than are nitrate prints. So much for the cost angle.

"Non-Flam" Tag Misnomer

We come now to one of the most widespread misconceptions regarding the physical properties of acetate film, the wholly erroneous idea that tags acetate with the misnomer of "safety film." If Mr. Kuykendall thinks that acetate film will not burn, it is suggested that he take, say, 500 feet of it and set a match to it in his own home. It is not contended here that acetate has the explosive qualities of nitrate film, but it is contended that the appellation of "non-inflammable" to acetate is wholly unwarranted.

Acetate film is designated by no less an authority than the National Board of Fire Underwriters as "slow-burning" film—which is precisely what it is. Acetate film will decompose upon exposure to flame or extreme heat at a *slower* rate than will nitrate—which is a far cry from a "fire hazard of exactly zero."

Moreover, there exists absolutely no justification for believing that the Underwriters would relax their present stringent regulations governing the production, shipping, storage and exhibition of acetate film, as Mr. Kuykendall so blandly asserts.

The assertion that the use of acetate film would permit a "shorter throw between projector and screen" and would "give a better picture with less light" is completely mystifying to anybody with even a smattering of technical savvy. The light-transmitting property of acetate is so close to that of nitrate film that the difference may be measured only by using the most sensitive instrument.

As for "throw," projection distance, Mr. Kuykendall evidently imagines that screen light is dependent solely on the distance between projector and screen, without any relation whatever between light source, type of lens, type and *size* of screen, and the amount of reflected light. Almost any projection setup, in terms of throw to cover a given screen area, is possible provided the focal length of the lens be changed constantly.

Mr. Kuykendall could set up projection apparatus far down the center aisle toward the screen in one of his theatres,

if he elected to utilize a wide-angle lens. For example, the throw in the 6,200-seat Roxy Theatre in New York City is only 100 feet, yet the auditorium itself is one of the widest and longest in the theatre field. Or, Mr. Kuykendall could do even better by utilizing rear projection, provided he wished to illuminate a comparatively puny screen area.

Film Base No Factor

In any event, neither throw nor the amount of screen illumination is even remotely connected with the type of film stock used, whether acetate or nitrate. But the tieing-in of these factors by the MPTOA president is eloquent testimony to the abysmal ignorance of most exhibitors about the very process that keeps their theatres operating—really the core of film exhibition.

As for the Kuykendall blast at two-men projection crews—that extra projectionist "who has nothing to do"—both projectionists and exhibitors are so familiar with the arguments pro and con relative to this situation as to require no recounting here. Any rational-minded person recognizes the need for one projectionist being at the operating side of a projector from which position he may observe the screen at all times, the while the second man attends to the other and manifold chores necessary in a projection room. But Mr. Exhibitor, wholly ignorant of all things technical, is never rational where a weekly wage is involved, particularly if the recipient of that wage be a member of one of those loathsome unions.

To summarize: the manufacturers of film stock say to Mr. Kuykendall that his proposal, considered only on the basis of quality and price, just can't be done. That settles that. However, if we have added to the sum total of Mr. Kuykendall's knowledge of the projection process (obviously "exactly zero" heretofore) he's more than welcome. Really, the job hardly required the stretching of a shoelace.

PLAN FILM TRANSPORT STUDY

Anticipating that the shipment by air of nitrate motion picture film will increase considerably, air transport operators are planning to make an extensive study of its packaging requirements. The research will be conducted by the 24 U. S. flag airlines comprising the Air Transport Assoc. of America, for the purpose of studying and preparing regulations dealing with the safe movement of hazardous commodities by air carriers.

Metal containers were used in transporting the film prior to the war, but the shippers and airlines were forced to adopt a spark-proof fibreboard during the emergency.

Since officials question the safety of the carriage of this type of material under existing regulations, nitrate film will be among the first items to be probed. The work will be directed by an expert chemist experienced in both general and laboratory work.

NEW RCA INDUSTRIAL CONTRACTS

RCA has supplied its industrial film recording licensees with new contracts which make available lowered costs for industrial films. This new basis will enable RCA recording licensees to capitalize on the anticipated up-surge of film production for television usage.

TELECASTS

DuMont has met the demand for low-price tele receivers by developing a new 7-in. cathode ray tube which provides a screen picture of high luminosity, 4¼ in. high by 5¾ in. to 6⅛ in. wide, and requires an accelerating potential of only 2500 volts. Its length being only 15½ in., it fits into a reasonably small cabinet.

DuMont has just leased a former silk mill in Clifton, N. J., to expand its manufacturing facilities, and when present plans are realized expects to employ about 5,000 people.

* * *

Before tele broadcasters can break even, set ownership must extend to 40% of all home owners, is the estimate of close observers of the tele economic picture. Ultimate coverage for tele receivers is set at 65% of the population, whether the set be installed in the home or elsewhere. It's the old story of advertisers insisting upon wide coverage before utilizing tele facilities, and broadcasters asserting the need for advertising support in order to spur set installation.

Tele-conscious advertising agencies point out that tele programs can cost considerably more than radio and still not exceed the costs to sponsors of obtaining a corresponding effect in magazines and newspapers. It costs the radio sponsor less than $.002 to have a customer hear his message, interspersed with more interesting material, for 15 minutes. It costs $.007 to do a comparable job in newspapers, and $.0025 to $.003 in magazines.

Advertising experts estimate that a television program has from 3 to 10 times greater sales impact than radio.

* * *

A writer in *PIC* magazine suggests that a tiny capsule of synthetic atoms built right into tele pickup tubes and image-receiving tubes would ideally solve the problem of how to obtain the necessary high-voltage, low-current power supply (25,000 to 60,000 volts) and eliminate the bulk that characterizes present-day transformers, rectifiers and other apparatus. . . . More people have invented "Sellevision" than any other tele-word.

* * *

The recent Television Institute meeting in New York was productive of some interesting comment anent the use of films in television. Dr. A. N. Goldsmith pointed out that at least one complete projection room is a "must" in any tele broadcast station, since film transmissions may occupy from 10 to 80% of the total service.

Present-day 16-mm standards just meet tele requirements of the moment, said Dr. Goldsmith, but it will be inadequate

(*Continued on page* 31)

Plastic Substitute for Optical Glass Seen

THE mass production of molded plastic optical elements through a new manufacturing process was disclosed recently by the Polaroid Corp., Cambridge, Mass. In the use of plastics for lenses, prisms and mirrors in telescopes and other high-precision optical instruments, the new method eliminates the laborious grinding and polishing operations required for glass optical materials.

At present, the mold production of plastic optical elements of the highest precision, required on high-power telescopes, is limited but it appears that many difficulties now encountered may be overcome.

Far more precise than ever before achieved in the synthetic material, the new plastic optics were developed during the war and were used in telescopes, experimental aerial cameras, binocular attachments and a Schmid-type lens system ten times more efficient than an F.2 camera lens.

Television Use Seen

The polaroid plastic optics are now being examined by optical engineers who believe that the new materials and production technique may provide low-cost optical systems for home television sets.

Research is continuing to overcome shortcomings of the plastic elements. That lenses, prisms and mirrors made from the materials are more easily scratched than glass is one problem.

The plastic optics are made by pouring fluid plastics of molasses-like consistency into precisely surfaced glass molds. The plastic is then hardened in a baking oven. This operation reproduces the surface precision of the molds to a very exact degree and the optics are ready for use when removed from the molds. Many elements may be baked at one time, thus doing away with the grinding and polishing of each optic as is required with glass.

The new development was reported in a joint announcement of the Office of Scientific Research and Development and the War and Navy Departments. Research into plastic optics was conducted by Polaroid under contract awarded by the National Defense Research Council in 1940 when it appeared that mass production of glass optics might not be possible. It turned out, however, that the expansion of the glass optics industry was achieved in time to meet most military requests.

The plastic optics supplemented the supply of optical glass, saved time and labor by producing elements which could be readily machined at the edges without danger of fracture, and reduced costs through mass output and utilization of semi-skilled and unskilled labor.

The new materials and production technique are suited for large, non-spherical optical parts which are usually employed in optical systems where the amount of light lost in transmission has to be kept at an absolute minimum. Plastic optics may be used in combination with glass, being placed at the eye end of instruments.

The scientists and engineers turned out, as one war job, a three-power, fixed-focus, telescopic sight with a fixed reticle for direct anti-tank fire designed for a three-inch M5-type gun.

To get the proper plastic for the new optics, 140 organic plastics were investigated. Two were standardized and put into production. One corresponds in its optical characteristics to crown glass and the other is used for elements ordinarily made from flint glass.

RCA EARNINGS DOWN IN '45

Net income of $8,204,470 after all charges including taxes was reported by Radio Corp. of America for the nine months ending Sept. 30, 1945. This is an increase of $1,469,800 over the $6,734,670 net reported for the corresponding period in 1944.

After preferred dividend payments, earnings applicable to the common stock for this year's period were 42 cents a share, compared with 31.5 cents for the 1944 period. Total income from all sources was $222,002,801, a decrease of $17,983,916 for a like 1944 period. Federal income taxes totalled $16,592,400, a decrease of about 5 million from the preceding comparable period.

TELECASTS

(Continued from page 29)

if the video industry goes to 700-800-900 line pictures. In the latter event, 35-mm film and equipment will be a necessity.

At the same meeting, Howard L. Purdue, of General Electric, cited some motion picture requisites for tele stations, as follows: a 16-mm projector and accessories, pick-up camera mounting and tube, camera sweep generator, video amplifier, shading and camera control equipment, and distribution and mixing panel. Estimated cost for the foregoing is $11,400.

Additional film units required include two 35-mm motion picture channels, projector and accessories, pick-up camera, etc., at an estimated cost of $48,000.

* * *

NBC is utilizing the longest focal-length lens ever employed for tele sports broadcasts. The unit is a 40-in. lens mounted on a regular Orthicon camera to bring viewers close-up pictures of outdoor events. NBC obtained use of the lens, for which a special bedplate and mounting were built, through the courtesy of the Bausch & Lomb Optical Co. Longest focal-length lens used for tele heretofore was 19½ in.

The new 40-in. lens has a 20-in. back focus and a speed of *f*5.6, while the diameter of the front glass element is 7 in. The back of the lens is about 20 in. from the mosaic of the camera tube.

* * *

RCA tele sets are expected to be on the market within the next four months, with table models selling under $200 and the de luxe screen projection units scaled at about $450. Picture sizes will range from 4 x 5 in. to that of full newspaper page.

* * *

The application of electronic control to the movement of cartoon characters is reportedly the subject of intense experimentation at the Walt Disney studios. Such a control is expected to reduce greatly the huge number of individual drawings now needed for a cartoon short.

Electrical Burn Treatment

Electrical workers, especially those dealing with high frequency currents, often get severe burns. The skin usually turns white around the burn, and heals very much more slowly than ordinary burns and wounds. The reason for this apparently is that the dead skin, if it be left in place, "poisons" the wound.

In the case of such a burn, the first thing to do is to remove thoroughly all burned skin, regardless of how painful this may be at the moment. One way is to use soap and water and a nail brush. The wound is then dressed in the ordinary way. It will be found that it will heal much quicker after this preliminary treatment.

I. A. Elections

LOCAL NO. 143, ST. LOUIS, MO.

Harvard O'Loughlin, *pres.;* Leo Canavan, *vice-pres.;* Harry A. Barco, *bus. rep.;* C. F. Kelsick, *rec.-sec.;* Roy Nicely, *fin.-sec.;* Charles Johnson, *treas.;* D. Lawson, Ed. Graves, *trustees;* G. Polito, Joe Schuller, Charles Serkes, *executive board;* Emil Werner, *sgt.-at-arms;* P. D. Petsenos, *guide.*

LOCAL NO. 145, GARY, IND.

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LOCAL NO. 150, LOS ANGELES, CAL.

Wallace Crowley, *pres.;* George Schaffer, *bus. rep.;* Magnus Nielsen, *ass't bus. rep.;* Charles Vencill, *sec.-treas.;* Ray Haskell, Paul Mahoney, Clair Piper, Joe Plyet, Clay Blanchett, *executive board;* Charles Crowe, Henry Kearney, Leo Stockwell, *trustees;* Virgil Crowell, Clint Bolinger, Paul Cramer, *exam. board;* Dick Seymour, *sgt.-at-arms;* Ben Vezie, *guide.*

LOCAL NO. 163, LOUISVILLE, KY.

Chester Demaree, *pres.;* A. Ansback, *vice-pres.;* Bob Hulett, *rec.-sec.;* E. F. Williams, *fin.-sec.;* Charles Hofer, *sgt.-at-arms;* Bob Hulett, P. W. Miller, *del. to IATSE Convention.*

LOCAL NO. 171, PITTSBURGH, PA.

Paul Ferry, *pres.;* Louis Indo, *vice-pres.;* Paul P. Mach, *sec.-treas.;* Wm. H. Thompson, *bus. rep.;* Luther Thompson, Wm. Metterson, John Urben, *executive board;* Mike Gardner, Henry Link, Sr., Jim Clair, *trustees;* Angelo Diodati, *sgt.-at-arms;* Luther Thompson, Louis Indo, Danny Flask, *del. to IATSE Convention.*

LOCAL NO. 173, TORONTO, CANADA

Arthur Milligan, *pres.;* Arthur Kerrins, *vice-pres.;* Patrick Travers, *rec.-sec.;* George Jones, *fin.-sec.;* Wm. P. Covert, *bus. rep.;* Carl Wells, Edward Shields, Jack Hill, Lou Lodge, *executive board.*

LOCAL NO. 181, BALTIMORE, MD.

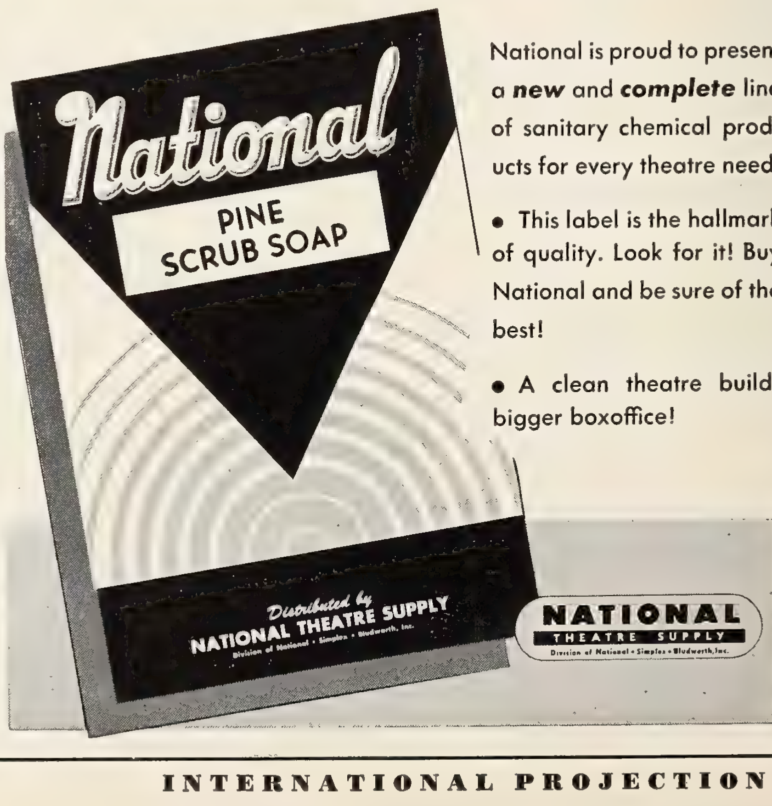
Thomas F. O'Hare, *pres.;* Wm. George, *1st vice-pres.;* Wm. Lange, Sr., *2nd vice-pres.;* Edward Eich, *3rd vice-pres.;* Andrew Provenza, *bus. rep.;* Maurice Rushworth, *rec.-sec.;* Thomas P. Finn, Sr., *fin.-sec.;* Wm. Frazer, Charles Grauling, Russell Clagget, *trustees;* Charles Spellman, *sgt.-at-arms.*

LOCAL NO. 182, BOSTON, MASS.

Thad C. Barrows, *pres.* (29th consecutive term); Joe Nuzzolo, *vice-pres.;* W. F. Diehl, *bus. rep.;* A. R. Moulton, *fin.-sec.;* Joe Rosen, *treas.;* H. Kaitz, *rec.-sec.;* Leon Narbut, Joe Ritchie, *executive board;* Wm. Hillman, *trustee.*

LOCAL NO. 186, SPRINGFIELD, MASS.

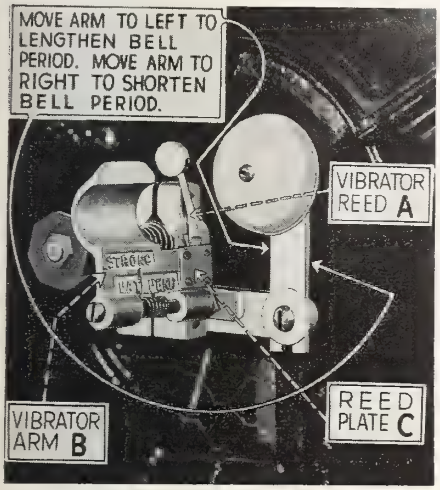
Ben Hull, *pres.;* Edw. Whittle, *vice-pres.;* Arthur J. Payette, *sec.-treas.;* Louis Williamson, *bus. rep.;* Owen Holmes, Howard Smith, Herb Binns, *executive board;* Joe Rodriguez, *sgt.-at-arms.*



Improved Reel-End Unit Offered by Essannay

An improved reel-end signal for all types and makes of projectors has been developed by Larry Strong (I. A. Local 110) of the Essannay Electric Mfg. Co., which also manufactures the Strong Zipper changeovers.

Strictly mechanical in operation, the new reel-end signal requires no batteries, no transformers and no governors, and pre-setting by the projectionist is unnecessary. Since the signal does not touch either the reel or the film, any danger of scratching is eliminated; nor is the signal dependent upon any change in the normal smooth operation of the projector.



Operation of the signal is simplicity itself: 1½ minutes before the end of a reel the unit gives a clear, distinct signal of 15 seconds duration; then it stops. The signal is adjustable for use with either 4- or 5-inch standard reel hubs, and its simple yet sturdy construction ensures long life without any care being required.

Installation of the unit requires five minutes at most, since no drilling is required. Circulars anent the signal, priced at $9.75, are available from the manufacturer at 1438 No. Clark St., Chicago 10, Ill.

LOCAL NO. 314, SCHENECTADY, N. Y.

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LOCAL NO. 425, KANKAKEE, ILL.

Stephen Hart, *pres.* (28th consecutive term); Brad Marcotte, *vice-pres.* and *bus. rep.;* Oscar Schmidt, *sec.;* Perry Powers, *sgt.-at-arms.*

LOCAL NO. 521, LONG BEACH, CAL.

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IN THE SPOTLIGHT

(*Continued from page 19*)

Pink Contract. Each man is to receive 6c per mile for the use of his car, plus an expense account to compensate for incidentals such as porter service, tips, and any other additional expense connected with the running of the show. Part time projectionists called for extra work will be paid $2.87½ per hour, with a minimum call of four hours, plus mileage allowance for their cars and an expense account. Projectionists employed by this company for one year will receive one week's vacation with pay, and those with the company two years or more two weeks' vacation with pay. Eighteen regularly employed men started working last month, and it is believed that eventually about 50 projectionists will be used.

Harvey Hill (left), Dallas L. 249; Eddie Miller, (center), Houston L. 279; and Murray P. Smith, Beaumont L. 183 holding a "serious" confab.

'Solid' Race Track Contract

A contract with the Telefilm Company, placing the men working in race tracks throughout the country under road contract is another achievement for Local 150. At the present time a full camera crew, a portable lab crew and one projectionist make up the unit established at the Santa Anita race track, and it is expected that the Telefilm Company will place similar units at all race tracks throughout the country. All men, with the exception of those employed locally, are on Pink Contract. The local projectionists receive the same scale as the road men with the exception that the road men receive an expense account to cover their living expenses.

Not bad, eh?

● We present to our readers a native son of Texas—Murray P. Smith, Local No. 183, Beaumont, Texas. For 35 of his 58 years he has held the office of business representative for the Beaumont local union, and if the members have their way it is a lifetime job for Murray. The Texas oil boom followed his advent into this world and the Murray Smith admirers (there are many of them down Texas way) attribute this boom to Mother Nature's celebration of the birth of one of Texas' most popular sons.

As a youngster Murray sold newspapers around the then high spots of Beaumont, netting as much as $75 per week. He was soon initiated into the intricacies of the galloping dominoes, poker, and other such cultural diversions, and his proficiencies in these forms of higher learning soon brought him renown throughout the length and breadth of Texas.

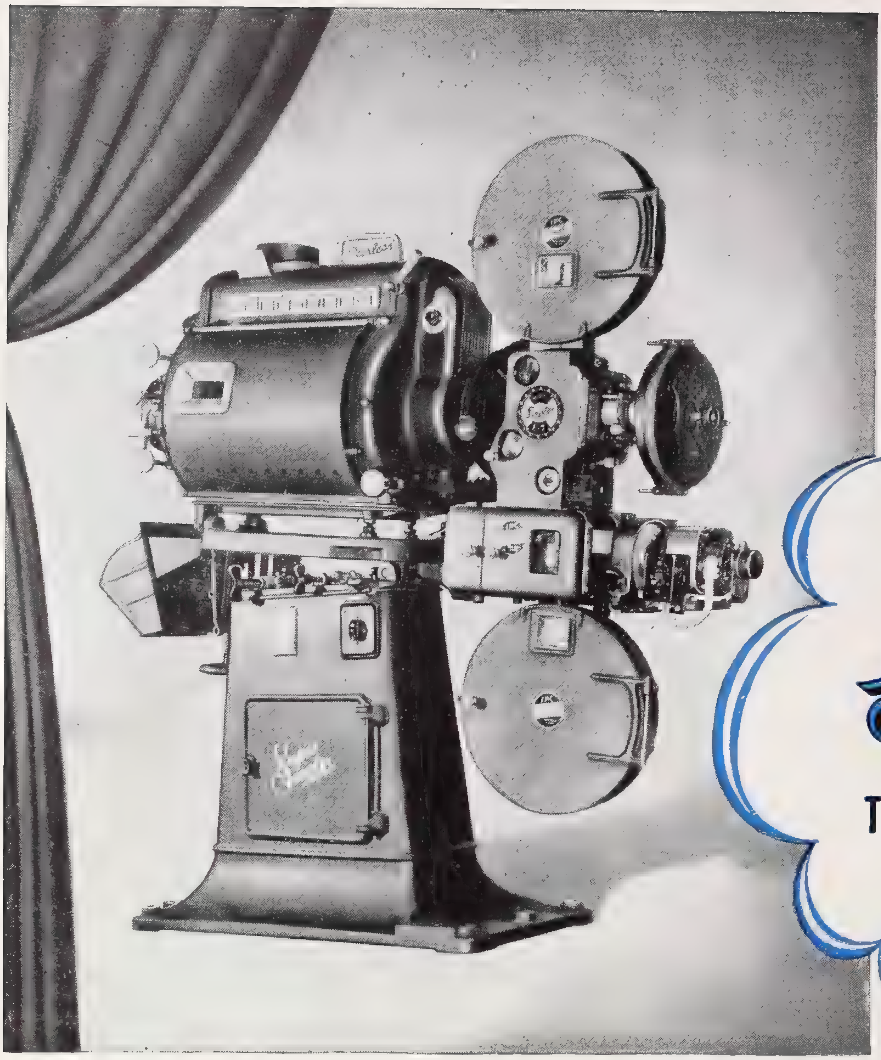
Murray seldom leaves his beloved state and only an important event, such as an I. A. Convention, could make him shake the dust of Texas even for only a short trip. He owns the Yukon Club in Beaumont, a popular spot with his friends, where he may be found dispensing true Southern hospitality.

Robert J. Taliaferro Dies

Long Beach, Calif., Local No. 521 mourns the loss of its late business representative, Robert J. Taliaferro, who passed away January 23 last, after an illness of two months. Bob Taliaferro had been business representative for Local 521 for the last four years, and had endeared himself to the members by his unflinching loyalty, his sincerity and honesty. He was one of those rare beings who was deeply concerned with the problems of his fellow workers, spending many a sleepless night worrying about their welfare. To the query "Am I my brother's keeper?" his answer was "yes," and always held out a helping hand to those who needed it.

R. J. Taliaferro

To the members of Local 521 we extend our deepest sympathy on the loss of their beloved brother.



INTERNATIONAL PROJECTIONIST

MARCH 1946

VOLUME 21 • NUMBER 3

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INTERNATIONAL
PROJECTIONIST

With Which Is Combined Projection Engineering

HENRY B. SELLWOOD, Editor

Volume 21 MARCH 1946 Number 3

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MONTHLY CHAT

SO KEEN has become the competition for the equipment advertising dollar among the exhibitor trade press that their so-called "Technical Sections" now recognize the projectionist as a person of some standing in the industry family and even deign to invite contributions from members of the organized craft. Also, a subscription from a projectionist (o-n-e, mind you) provides the basis for a full-page, self-laudatory house ad.

Some of our readers might object to a brother craftsman imparting a bit of projection savvy to exhibitors, in an exhibitor paper; but this corner, mindful of the ignorance in matters technical of Joe Exhibitor, views this development with equanimity. The world won't last that long.

The old adage anent "running with the hares and the hounds" came to mind recently when we read a house ad reciting the accuracy of a picture-checking service rendered by an exhibitor paper that makes a great to-do of "servicing" the projectionist. Discussing footages and running times, this ad proclaimed:

"We're mighty thorough, too, because . . . if we weren't, a theatre . . . might have to pay its projectionist overtime . . ."

Are you guys listenin'?

• • •

Correspondents suggest, none too subtly, that we are crying "Wolf!" too frequently and too strenously relative to the threat to craft security posed by the imminent arrival of commercial television and by the projected setup of a national 16-mm exhibition circuit.

We think not. It remained for the SMPE to make the first move to establish definitely the probable effect of television upon the motion picture theatre, and we may expect that the results of this survey will be both accurate and extremely interesting. On the 16-mm front, we're not quite satisfied with the distributors' repeated promises that they will service only "non-theatrical" accounts. The term "non-theatrical" has taken on too expansive a character down through the years.

Better cry "Wolf!" and play safe on the pessimistic side rather than be somnolent and rely upon the morrow's sunrise to dissipate the mists. Incidentally, the SMPE inquiry merely serves to emphasize the ineptness of exhibitor groups whose chief concern at the moment should be projects of just such character.

• • •

Severe shortage of vacuum tubes is anticipated as a result of unsettled labor conditions. Delivery of glass envelopes, no less than other components such as tungsten filaments, is rapidly approaching a hit-or-miss basis. Don't aggravate the situation by stocking above the normal quota; but do check present stocks and exercise every caution to insure continuing operation of reproducing units.

Service companies report ample tube stocks for normal needs.

INTERNATIONAL PROJECTIONIST

VOLUME XXI MARCH 1946 NUMBER 3

Elements of Projection Optics

By *ANGELO MONTANI*

CONSULTING ENGINEER, NEW YORK CITY

No phase of the projection process is subject to so many misconceptions as are the optical principles involved therein. True, the end results are well-known, but the means by which these results are attained are all too obscure to not a few otherwise highly competent craftsmen. The accompanying aricle is the first of a series relative to this vital element of the projection process. Questions bearing on the points developed in this series are solicited.

THERE are generally two ways to learn about natural phenomena—qualitatively and quantitatively. The latter course presents the most difficulty although yielding more precise knowledge. Almost everyone is acquainted with the common phenomenon that a decrease in the ambiental temperature converts water into ice. This fact is so universally known that it is referred to as "common knowledge." This is because of the intuitive distinction between the "quality" of liquid and that of a solid. This is "qualitative knowledge."

A more "quantitative knowledge" consists in knowing that water turns into ice when the temperature decreases below 32° F. This is simple quantitative knowledge known to millions of people.

A minority of people know that the freezing point of water and of other liquids varies according to the atmospheric pressure. If we now wish to know how and why this phenomenon happens, then we need a still more quantitative and keener understanding of matter.

In the present discussion of optical principles and their practical applications to prisms, mirrors, and lenses we will endeavor to stress the qualitative phase as much as possible because of the intuitivity of this kind of knowledge.

For the present it will suffice to think in generalities and therefore we will not attempt to define the very nature of light. We wish only to emphasize that although everyone knows what light means as a phenomenon, so many facts are taken for granted that, in general, people do not even suspect that there *is* something to say about it.

The mere fact that in a certain position of space we have generation of light does not account for the fact that we "see" light. Even the fact that we possess a light-receptive sense, the eye, still does not explain why we can see a light source a few yards or a few miles away. Light source and the eye are separate. The light must span the distance between the source and the eye of the observer: it must be *transmitted.* Therefore light must travel through a medium which is able to transmit the sensation to the eye of the sensitive plate of a camera.

Light Beam Path

Deferring consideration of the transmission of light, let us first make a simple statement: light beams proceed according to straight lines. This is intuitive and correct, provided the nature of the space through which the light travels does not change in density, but remains homogenous. If the light beam proceeds through air, glass or water, the beam will continue straight, provided no changes are present in the different portions of space traversed.

From the practical point of view, we might call this straight-line behavior of the light beams the "negative side of the picture." In fact, all "useful" optical systems have the scope of modifying the straight path of the beams, bending them in patterns which are necessary to obtain application uses.

A light source directs rays in all directions in the same rough way as a sea urchin directs its spikes. An opaque screen with a small central hole is useful to select a narrow beam of rays which, for all our purposes, may be considered a beam of parallel rays.

If a mirror be positioned in the path of the beam, its straight course is interrupted and the new path of the reflected beam forms an angle with the previous direction. The same occurs if we interpose in the path of the beam a polished block of glass. If the surface facing the direction of the rays is not flat, but convex or concave, the beam is collected in a bright spot or scattered in its elementary components.

When a surface coated with a thick layer of lamp-black is positioned in the path of the beam, all of the light is absorbed. A sensitive thermometer in contact with the black surface will show a rise in temperature due to the equivalent heat generated during the absorption of the luminous energy.

The foregoing are all familiar phenomena and we will examine them in greater detail in the development of the present exposition anent practical optics.

Let us take a piece of metal—steel, for example—and press it slightly against a grinding wheel motion. The metal warms up. Applying a stronger pressure, the surface of the metal in contact with the wheel becomes red hot and quite soon very brilliant sparks begin to fly around.

Just by applying mechanical energy through friction to the metal, it at first became very warm, then cherry red, and finally incandescent. In fact, as we know, the sparks represent small incandescent particles of the metal. The

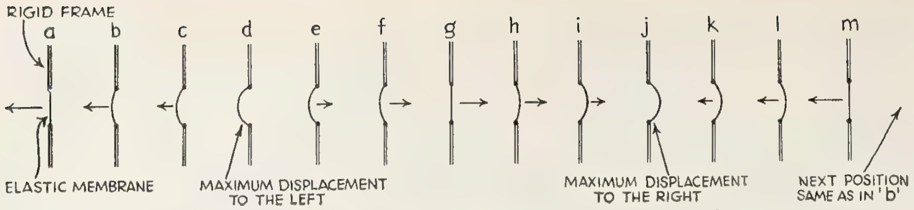


FIGURE 1. ***Sectional view of the instantaneous positions of a vibrating elastic membrane. Arrow indicates magnitude and direction of the vibrational velocity.***

cigarette lighter utilizes the same phenomenon. The hard flint is ground in incandescent particles which fire the fuel.

We have learned from physics that matter is composed of small elements called atoms. These atoms are made up of much smaller elements of which we will name only one: the electrons. When these sub-atomic elements are disturbed they generate heat and light. The disturbing energy can be applied to the electrons in several ways, as, for instance, chemically by applying fire; electrically by passing an electric current through the metal to which they belong, or mechanically by friction, as mentioned previously.

We cannot insist further on the generation or emission of light as an atomic phenomenon because it requires a too great amount of specialized, and therefore quantitative, knowledge. Besides, for the full understanding of the practical laws of geometrical optics, it is enough to know that light springs forth from the inside of the atoms when they undergo certain disturbing causes which affect their equilibrium.

Consider the filament of an incandescent bulb. Here every atom reacts in a certain way to the passage of the current. Every atom contributes its tiny bit of heat and light. Now multiply the "little bit" contributed by all of the billions and billions of atoms which constitute the bulb filament, and you have a reasonable amount of light.

We might better consider the generation of light as a vibration happening inside the atoms, which, when it occurs, is carried into the surrounding space by an elastic medium which has been called "ether." A classic example will help us to visualize the propagation or transmission of light through space:

A pebble is thrown on the calm water of a pond. At the point where the pebble strikes the surface of the water a vibrational ripple is formed. The ripple does not remain stationary but spreads out in circular waves which reach into the remotest corners of the pond. This is an example of a disturbance which propagates on a surface, but it has the advantage of being intuititive and universally witnessed.

A bell which rings is another example of a disturbance which does not remain confined to the space where it happens but is transmitted through the air as a spacial disturbance. In the absence of air, there would be no transmission of the disturbance, which in this case is a sound.

Light transmits through a vacuum where no trace of air exists, therefore it must be a disturbance which is transmitted through another medium. This particular medium has been called "ether," although modern physics does not need to labor the ether theorem to explain the propagation of light. Accepting, even as a working basis,

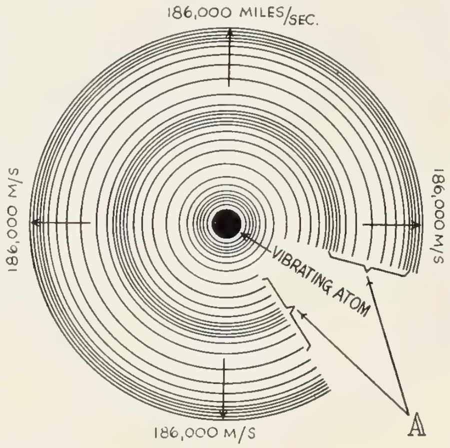


FIGURE 3. ***Distance between close lines or between broadened lines (A) corresponds to one complete vibration performed by the atom.***

the existence of the ether, it is much easier for us to become acquainted with the propagation of light as a propagation of a vibrational phenomena similar, with certain restrictions, to the sound waves and the waves of the water. It is necessary for us to grasp the concept of virbration in its fullest sense before we can begin to learn about reflection and refraction of light.

Vibratory Transmission

Figure 1 shows the section of a vibrating membrane, like that of a telephone receiver, in all its different instantaneous positions. The membrane supposedly in a space without air, first bends to the left, continues to go to the left until it reaches a maximum; after which it retraces its steps, passes through the null position, and then bends equally to the right. After the maximum excursion to the right is reached, the membrane comes back, passes through the null position again, and the phenomenon is repeated in cycles.

Figure 2 shows the same membrane vibrating in air inside of a tube. The unevenly spaced dashed lines represent the layer of air molecules. The bunched lines represent compressed air, and the lines far apart represent rarefied air.

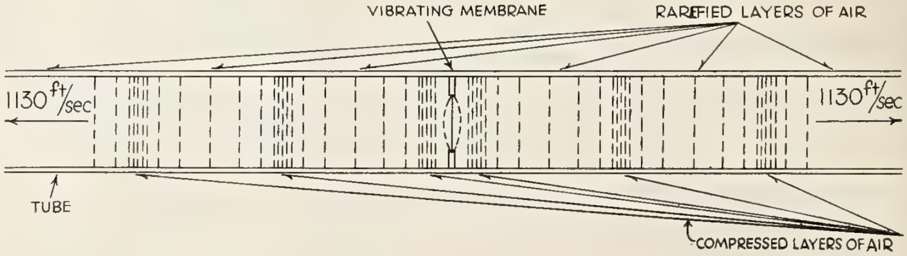
The layers of compressed and rarefied air do not remain in the space where they form but expand, traveling with a velocity which is dependent upon the particular gas. In air this velocity is about 1130 feet per second. This means that a compression produced by the vibrating membrane now will be found at 1130 feet from the membrane after one second, at 2260 feet after two seconds, and so on. Let us always keep in mind that these figures represent a section of the membrane and of the disturbances which must be imagined to exist above and below the flat surface of the printed figure on a page.

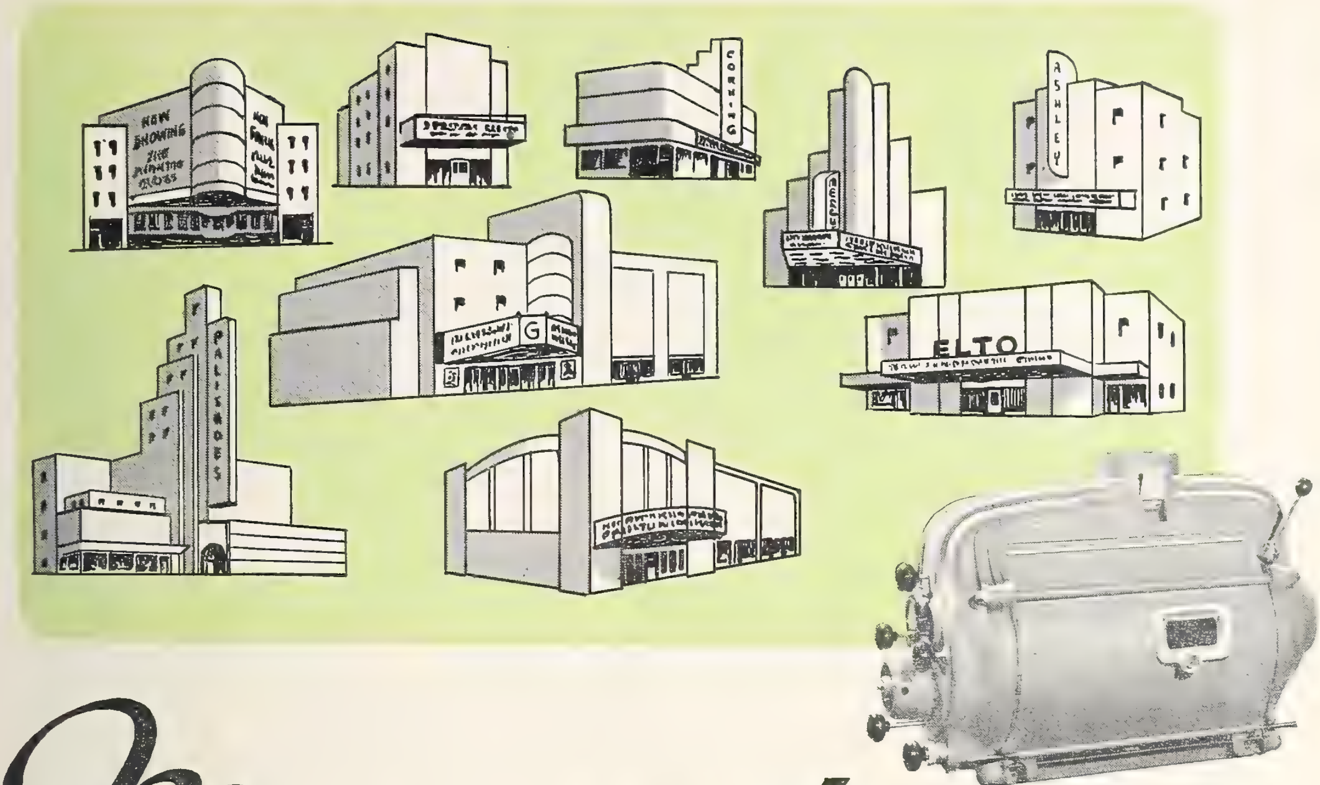
Let us go back to our atom generator of light which we will represent as a small sphere, or better still, as a pulsating sphere. This means a sphere which periodically increases and diminishes its volume like a pneumatic balloon which is partially filled with air and then evacuated (Fig. 3).

Around the atom we will expect to see generated layers of compressed ether moving away from the atom. Actually this does not occur, since each particle transmits the motion elastically to the next particle. In such a way, the disturbance is transmitted although no particle accompanies it. (A mechanical vibration is transmitted through a bar of steel wherein every particle of steel yields its motion to the next one while still keeping its average position in the bar).

The disturbances imparted to the ether (light being one) travel at a speed of 186,000 miles per second. That means that a disturbance generated now by the atom will be found at a distance of 186,000 miles from it after one second; 372,000 miles after two seconds, etc.,

FIGURE 2





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An Improved Loudspeaker System†

By *J. B. LANSING and J. K. HILLIARD*

ALTEC LANSING CORPORATION

Herewith a description of the new Altec-Lansing 2-way loudspeaker for theatres. New permanent magnet low-frequency and high-frequency units having replaceable diaphragms are combined in a horn system having the following advantages: higher efficiency, extended frequency range, p. m. units providing higher air gap flux densities, the elimination of backstage radiation from the diaphragms, better transient response, and an improved overall presence.

THE use of the present 2-way multicellular horn systems over the period of the last 10 years has permitted theatre sound quality representative of the sound recording technique available during the same period. However, during this 10-year period, experience has been gained indicating that still better recording technique is possible when better loudspeakers are available for monitoring purposes.

New loudspeakers are now available for this purpose, and they bring the quality of sound even nearer to the ideal objective of sound engineers. We want improvement in both high- and low-frequency units, and we want the use of these units in a loudspeaker system having greater efficiency, higher power capacity per unit, better transient performance, an extension of the frequency range, a higher definition in quality, and a better overall presence.

But it is necessary to have a new loudspeaker system (Fig. 1) in order to gain these improvements. Before such a new horn system could be developed, other things had to come. We had to have new methods of manufacturing diaphragms, we needed better voice coil construction, and magnets had to be deevloped that would be considerably superior to anything we have had in the past. These magnets came along as a development in the war industry.

In the past, poor presence has been one of the principal deficiencies, attributable to several causes. As an example, dips in the 250-500-cycle region tend to give the effect of individual low- and high-frequency sources. Resonances in the low-frequency units and horns have accentuated narrow bands. Backstage resonance, caused in part by radiation from the rear of the speaker system, has caused detrimental hangover and masking of the auditorium sound with an attendant loss of presence.

Long air column, l. f. horns become involved in phasing trouble and loss of presence is encountered owing to the fact that the apparent source of sound tends to recede back in the horn progressively with an increase of frequency. Folding of the horn tends to limit the frequency range in proportion to the sharpness and number of the turns. Rigidity is necessary so that the walls of the horn will not vibrate and dissipate sound power by absorption and also give uncontrolled directional effects.

With this long list of difficulties in mind to begin with, new low- and high-frequency units were designed. These units have improved impedance characteristics, longer life diaphragms which dissipate more power safely, permanent magnet units with diaphragms that can be changed easily, and new magnetic circuits combining long life at high efficiencies.

† *J. Soc. Mot. Pict. Eng.*, November, 1945.

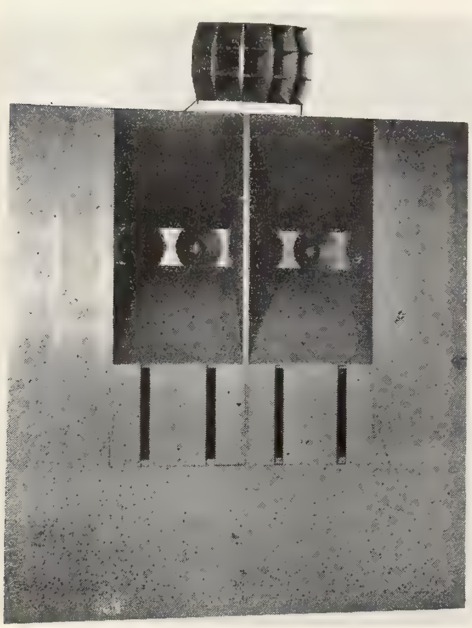

FIGURE 1. *Front view of A-2 loudspeaker.*

288 High-Frequency Unit

One of the basic improvements in the loudspeaker system has resulted from the design of a new h.-f. unit. The larger metallic diaphragm units available in the past have used the annular type of compliance. This type of compliance, while adequate at high frequencies, did not provide the necessary amplitude at lower frequencies. As a result, both the power and frequency characteristics in the region from 250-500 cycles have been found inadequate owing to the inability to handle the necessarily large excursion properly.

FIGURE 2. *Front and rear views of 288 replaceable diaphragm assembly.*

Recently, J. B. Lansing has developed a hydraulic method of drawing metal diaphragms which simplifies the process considerably over previous methods. As a result, it is now possible to draw larger diaphragms and provide a tangential compliance in these larger sizes. This method provides an amplitude approximately 3 times as great as the annular type and the increased length of compliance insures that the diaphragm (Fig. 2) can operate at the required amplitude without undue strain.

The voice coil is wound with rectangular aluminum ribbon which has been treated with a temperature resistant varnish so that it will safely dissipate higher power without damage. The use of edgewise wound ribbon provides more volume of conductor in the magnetic circuit which, in turn, increases the efficiency. Beryllium copper leads are spot-welded to the voice coil wires. This provides a heavy duty lead (Fig. 2) which will not fatigue under use.

The entire voice coil and diaphragm assembly is mounted in a cast bakelite ring. The voice coil leads are clamped and soldered under flat terminals and

a screw is provided for fastening each connecting lead to its binding post. By removing the leads to the binding post and 6 screws which anchor the bakelite ring to the top plate of the field assembly, the diaphragm and voice coil may be removed for replacement purposes. Two dowel pins are provided for alignment.

The use of this method of mounting the diaphragm assembly permits its removal even though the magnet is charged. As a result, field replacement of the assembly is a simple operation and does not require that the entire unit be returned to the factory nor does it require any special tools.

The entire unit (Fig. 3) weighs 21 lbs., which is considerably lighter than previous units of comparable efficiency and power capacity. The impedance of the unit when mounted in a properly matched horn is approximately 24 ohms over a wide frequency range.

Excitation of this new h.-f. unit is obtained from a newly developed Alnico No. 5 permanent magnet material. The flux density is greater than has been used in the best separately excited units supplied.

515 Low-Frequency Unit

The magnet itself is of the center-core type. The soft magnetic material forming the path between the pole pieces is amply designed so that the flux is conducted through the outside walls and up to the air gap with little loss. The external leakage loss is extremely low in this design, and as a result does not attract metal objects in the immediate vicinity. The efficiency of the 288 h.-f. unit when mounted in a suitable multi-cellular horn is such that a sound level of 98 db is produced at 5 ft. distance for an electrical input of 0.1 w at 1000 cycles.

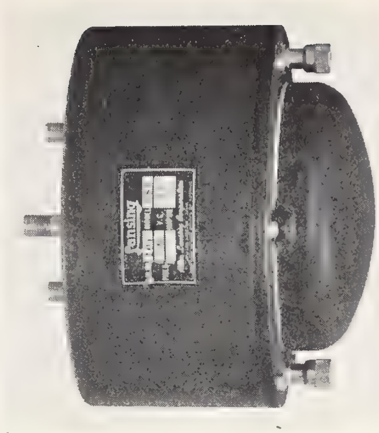

FIGURE 3. *Side view of 288 high-frequency loudspeaker.*

FIGURE 4. *View of 515 low-frequency loudspeaker.*

The 515 l.-f. unit is mounted in a 15-in. die-cast frame which assures permanent alignment of the cone and voice coil assembly, as shown in Fig. 4. It uses a seamless moulded cone having an effective area of 123 sq. in. and is moisture-resistant. An edgewise wound copper ribbon coil (Fig. 5) is attached to the cone and a dome is inserted in the center of the cone to provide the maximum active vibrating area. The use of edgewise wound copper ribbon improves the space factor over that of round wire, and since more conductor material can be placed in the air gap, the efficiency is raised and the operating temperature decreased.

Since the 3-in. voice coil diameter is considerably larger than the 2- and $2\frac{1}{2}$-in. diameter coils formerly used, it has a correspondingly increased ability to handle higher power without undue temperature rise, and, as a result, the efficiency is little affected with changes in power.

The Dividing Network

A clamping ring fastens the outer rim of the cone to the frame. The inner spider assembly is held down by means of screws so that it is a simple operation to remove the entire voice coil and cone assembly for replacement purposes.

An Alnico No. 5 permanent magnet is provided for the field excitation. The total energy available with this magnet is greater than that previously supplied in energized units now being used.

The resonance of the cone and voice coil assembly is 40 cycles in free air. The impedance of the unit is approximately 20 ohms as normally used. The unit will safely handle an input signal of 25 w. The unit is $15\frac{3}{16}$ in. outside diameter, 8 in. deep and weighs 33 lb.

The *N*-500-*C* dividing network used (see Fig. 6) is a parallel-type constant resistance network. It consists essentially of a low- and high-pass filter designed to operate from a common source at their input ends. The insertion loss of the network is less than $\frac{1}{2}$ db. The crossover point is at 500 cycles, at which point the power is divided between the high- and low-frequency legs such that each branch is down 3 db.

Provision is made for 5 steps (1 db each) of attenuation in the h.-f. output. This is accomplished by changing the shorting strip held under 3 screws. The input impedance of the dividing network is 12 ohms.

Loading Factor of Unity

The new improved l.-f. horn (Fig. 7) which is used for medium-size theatres has two 515 l.-f. units mounted beside each other in a straight exponential horn. The area of the throat of the horn has been made approximately equal to the area of the 2 diaphragms, giving a loading factor of unity. This increased loading over that formerly used provides better damping of the units and increases the excursion of the diaphragm.

These new units are enclosed from the rear (Fig. 8) so that radiation from the back side is dissipated in the enclosure. However, at frequencies below 100 cycles this dissipation is not complete and ports are provided in the front of the speaker, below the mouth of the horn. These ports provide an

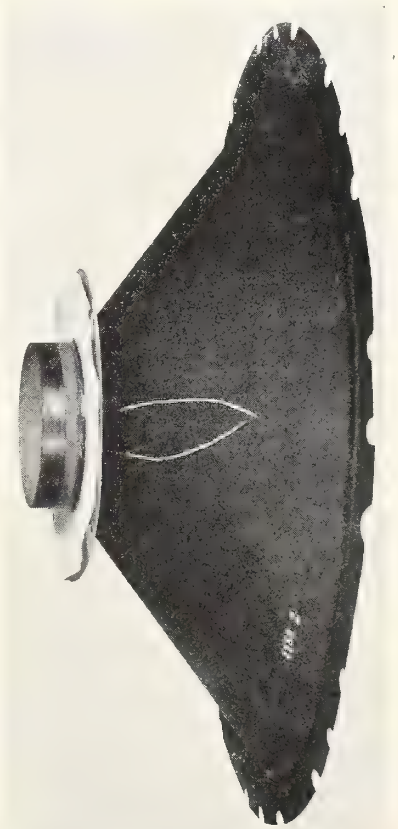

FIGURE 5. *Replacement cone and voice coil assembly for 515 low-frequency loudspeaker.*

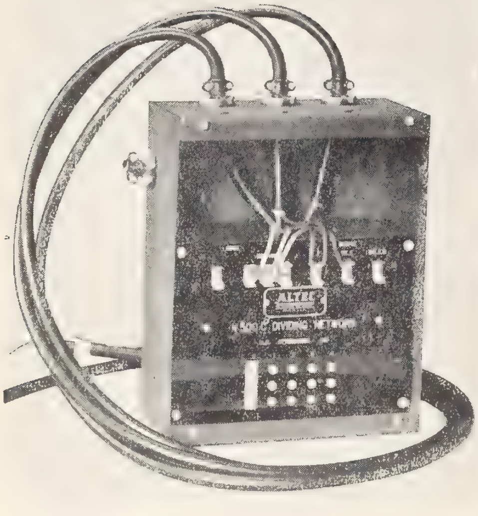

FIGURE 6. *N-500-C dividing network.*

acoustic impedance which raises the output several decibels around 50 cycles. Wings are provided for additional l.-f. loading.

One 288 h.-f. unit is used on the proper horn, which depends upon the shape of the room.

Relative Phasing Important

Early experience with the first 2-way loudspeakers indicated that the relative phasing of the 2 units was important. For correct phasing the 2 horns must have equal path lengths. The design of previous loudspeaker systems has not permitted this optimum phasing condition to be obtained.

Measurements recently made out of doors in free space indicate that wide variations in response can be obtained at the crossover frequency when the horns are shifted so that the mouths of the horns are not in the same vertical plane. This new horn system has a path length such that the tip of the h.-f. multicellular horn mouth is exactly in line with the mouth of the new l.-f. horn for correct phasing, and under these conditions there is no variation in the response at the crossover.

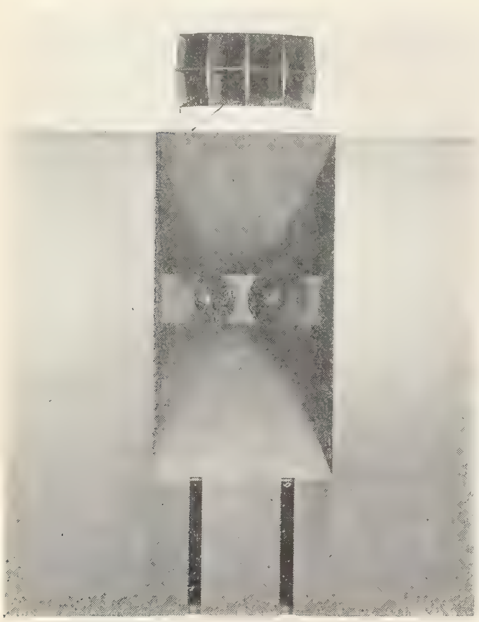

FIGURE 7. *Front view of A-4 loudspeaker system.*

The *A*-4 medium size horn system (Fig. 7) has a rated capacity of 40 w. Destructive tests indicate that this rating provides a safety factor of greater than four over that necessary to damage the unit.

The *A*-2 large size horn system (Fig. 1) is composed of 2 l.-f. horns placed side by side and two 288 h.-f. units mounted on a double throat. The dividing network is mounted on the side of the baffle. The installation time is materially decreased, since the only wires needed are those from the output of the amplifier.

Sufficient damping of the vibrating elements of the units are provided in the magnetic circuit so that it is not necessary to provide additional damping from the driving amplifiers. In the past it has been customary to adjust the amplifier output impedance to a value of approximately one-half to one-third of the average speaker impedance. Improved performance can be obtained with the new loudspeaker when the amplifier and speaker impedances are approximately equal.

Anticipating that these new systems may be called upon to provide the sound channel in television work. it was necessary to restrict the stray magnetic field in order to prevent magnetic distortion of the television image caused by the proximity of the cathode-ray tube. Additional benefits from these features of the design are increased efficiencies owing to lower magnetic losses, and the fact that it is possible for these new permanent magnet units to be handled without endangering wrist watches or other devices which may be susceptible to damage from magnetization.

High Efficiency Rating

The efficiency of this new horn system is from 2-8 db higher than commercial loudspeaker systems now in use in theatres.

Since the new horn systems have a smoother l.-f. response, experience to date indicates that a bass boost as much as 2 db at 50 cycles may be used with present product without interfering with dialogue quality. The straight l.-f. horn provides an unattenuated output up to and beyond the 500-cycle crossover point. This increased output in the region from 300-500 cycles over that of older horn systems adds materially to the presence and loudness of the overall system.

Recording and re-recording staffs in the studios indicate from their listening tests that over a period of time it should be possible to fully utilize the increased performance of the new speaker system so that a smoother and more extended frequency and volume range can be reproduced.

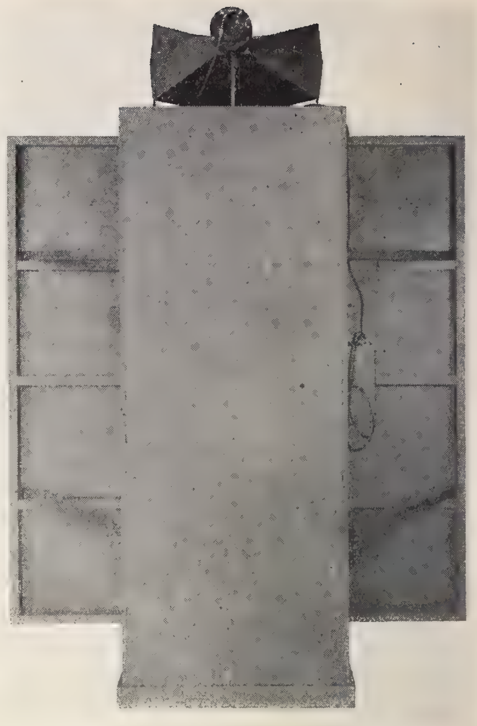

FIGURE 8. *Rear view of A-4 loudspeaker system.*

It is our feeling that the presentation of these loudspeaker systems will be a distinct aid to sound equipment manufacturers in preparing their designs of future theatre sound systems in order that the industry may not be limited to the quality standards established by older speaker systems.

Summary of Advantages

Similarly, the higher quality standards which can be reached through the use of these loudspeaker systems influence studio recording and monitoring practices. Because of the long interval which necessarily intervenes between the recording of a motion picture and its presentation to the public, considerable time must necessarily elapse before the full influence of the advancements in recording and reproducing can be presented to theatre patrons.

The advantages of the new Altec Lansing loudspeaker systems are summarized as follows:

(1) Higher efficiency; (2) Wider frequency range with a better transient response; (3) New permanent magnets; (4) Diaphragms that are easily replaceable.

(5) No backstage resonance; (6) A higher safety factor at increased power. and (7) An improved overall presence with a much better definition of sound quality.


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Some Common Acoustic Troubles

By *LEROY CHADBOURNE*

THE SIZE, shape, design and materials of the theatre auditorium are matters apart from the projection room, as are the auditorium decorations and seating arrangements. But poor sound resulting from auditorium conditions (particularly when those conditions change) is definitely a concern of the projectionist, who may ascribe such defects to the sound apparatus and thus occasion much needless trouble and loss of time.

For example, if a lighting fixture chain in the auditorium changes in tension until it vibrates with the sound and creates an unpleasant resonant noise, futile attempts may be made to find the cause of that resonance in an amplifier or a loudspeaker.

Again, every projectionist knows that volume must be adjusted according to the size of the audience, because this factor exerts a potent influence upon the sound volume; but it is not always so well realized that the size of an audience may affect the *quality* of sound as actually heard.

New sound equipment that is tested in an empty auditorium will give very different results in quality from those it delivers when an audience is present, not because the sound system has changed but because the acoustic conditions have been altered. Tone control adjustments made in an empty auditorium should be reset accordingly.

All changes in the auditorium, including redecoration or reseating, even painting, may involve acoustic changes that the manager, the painter and the carpenter know nothing at all about. The projectionist is left as the only technically trained person in the theatre who can be of the slightest help.

However, a primary concern of the projectionist with acoustics is to make sure that he doesn't incur underserved blame, or himself blame the apparatus, for conditions outside his control. Second, when he knows a given trouble is acoustical and not mechanical or electrical, he can be of more help than any of the non-technical staff members.

Resonance Troubles

This article will discuss briefly acoustical troubles, their recognition and solution, due to (1) resonance, and (2) mal-distribution of sound, and (3) reverberation. These deficiencies are largely in the province of the theatre manager. Reference will be made in passing to the more common acoustical terms likely to be used by special consultants.

If any pure sound strikes strongly on a violin string or piano wire that happens to be tuned to *identically the same pitch,* the string or wire will vibrate "in resonance."

In a theatre there may be some attuned object—such as a lighting fixture chain or, possibly, one of the chains by which the loudspeakers are suspended, or even a section of paneling—that will resonate to the reproduced sound and thus create a rasping, highly unpleasant effect. Almost invariably, this problem will be referred to the projection room.

Proper recognition of this trouble involves, first, noting whether the same raspy sound is heard in the monitor speaker. If not, the cause is not in the projection room—unless the monitor speaker is connected to the voltage amplifier, in which case some defect in the power amplifier is a possibility. If the latter is checked (or seems unlikely in view of the condition of the power amplifier) listen to the screen speakers from a point very close up. If the raspy sound is heard as loudly as in the auditorium, it may be caused either by a defective diaphragm or by a resonance of some object very close to the speakers, such as one of the suspension chains.

If the unpleasant sound is heard only in the auditorium, it is certainly a resonance trouble, to be located by determining the region where it is loudest, and looking there for taut chains, loose panels, or anything else that could vibrate in resonance with the sound. When the offending object is found, merely touching it will provide the answer, because this will alter its pitch. The next step is to tighten that object; or change its tension until it doesn't resonate; or remove it, or cover it with sound-absorbing material.

Especially when the resonating object is located high up near the center of the ceiling, so that the effect is heard with nearly equal strength throughout the auditorium, there will be every tendency to suspect the sound system unless the aforementioned listening tests are made.

In many theatres loudspeakers are not so installed that they can never shift position. Often they are so mounted that they can be "flown" to make room for a stage show. In other spots they are merely placed in position on the screen platform but not bolted. Then again, some or all speakers are suspended in position by chains or even ropes.

Mal-Distribution of Sound

Sometimes speakers merely placed in position but not bolted down are shifted accidentally by the porters. Where speakers are suspended by chains, loosening of one chain or its connections may cause the units to point in a different direction. Ropes (which should never be used) contract or loosen according to the changing moisture content of the air, and speakers may shift somewhat in consequence.

In all such cases two troubles may be encountered. One is loss of volume, the sound being directed on the ceiling or on some strongly absorbent surface. The other possible trouble is loss of quality, since the reflection of sound from different auditorium surfaces may change substantially if the directional distribution be altered. Projection room equipment is then the first suspect.

Where speakers are not rigidly and permanently mounted so they cannot shift, any change in sound values should be checked with the monitor speaker. Unless the fault is heard in the monitor also, it would be wise to investigate the speakers before doing any extensive projection room work.

Where it is not possible to mount the speakers immovably, guides of some sort should be marked on the screen platform, on the rear of the screen, or otherwise provided, so that the correct placement and position of the speakers will always be known. Thus, any change in their orientation will be instantly visible on inspection.

Since sound consists of waves of air, and since these waves are reflected from hard, solid surfaces, the audience hears two kinds of sound: the direct waves from the loudspeakers, and the reflected waves from walls, ceilings etc.

Enclosures have been intentionally built with interior surfaces made of such absorbent materials that there is practically no reflection. Sound in such enclosures is very "dead" and unnatural, because normally there are almost al-

Acceptable Limits of Reverberation Time in Seconds

Volume Cubic Ft.	Max. Audience	Half Audience
10,000	0.9-1.2	0.6-0.8
25,000	1.0-1.3	0.8-1.1
50,000	1.2-1.5	0.9-1.3
100,000	1.5-1.8	1.2-1.5
200,000	1.8-2.0	1.4-1.7
400,000	2.1-2.3	1.7-2.0
600,000	2.3-2.6	1.8-2.2
800,000	2.5-2.8	1.9-2.3
1,000,000	2.6-2.9	2.1-2.5

ways present reflecting surfaces as well as absorbing ones.

On the other hand, if the enclosure is built with too much reflection and not enough absorption, it will sound like an empty barn, or like shouting into a barrel. Sound will also become less intelligible, because the multitude of reflected waves, arriving at the ear of the listener at various fractions of a second after the original, or direct wave, will sound blurred.

Reverberation Fundamentals

The effect produced by the reflection of sound is called reverberation. Special cases of reverberation should never be confused with equipment deficiencies.

Echo, for example, is a directional, concentrated reflection from a surface located at a considerable distance—say, at least fifty feet. There is also a "standing wave" effect in which two opposing, reflecting surfaces are so located and spaced as to create points between them where the reflections reinforce each other and the sum total of sound is very loud. At other points between the two surfaces the reflected waves oppose each other and volume is weak. Nobody would ever charge these defects to the sound apparatus — unless the projection room ports are open and the "echo" is the sound of the monitor! Could be and has been.

But the poor quality resulting from either too little or too much reverberation may be attributed to the projectionist and his equipment. For example, if changes are made in the auditorium and if sound equipment is overhauled at the same time, subsequent deterioration in sound quality may be laid to the changes made in the sound system without consideration of the possible acoustic effects of redecorating or of painting over some sound-absorbing surface and thus destroying some of its absorbing power.

Some managers want to know what could be wrong with a "crazy" system that gives good sound in the evening, and poor sound in the afternoon. This same apparatus, strangely enough, functions very well on Saturday afternoons.

Audience a Factor

If a theatre has too much reverberation, quality will improve with a large audience, because people and their clothing are excellent sound absorbers. If, on the other hand, a theatre has too little reverberation, sound quality will be best when there is a small audience. Thus, sound quality may appear to change with the time of day or day of the week, when in reality it is only changing with the size of the audience.

In any case of poor quality sound that might reasonably be due to auditorium conditions, or to changes therein, triple-check by using the monitor, by using headphones, and by listening very closely to the loudspeakers.

Reverberation Time

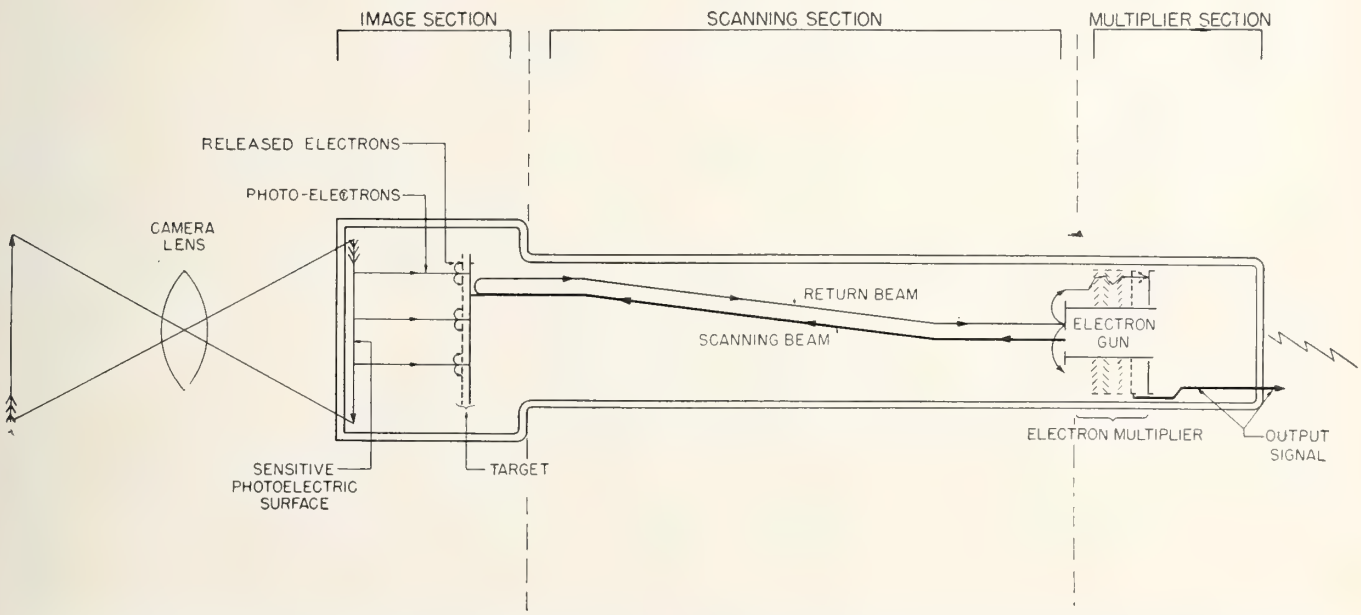
In small rooms, where walls are close to each other, there are many reflections of sound per second, and since energy is lost at each reflection, the reverberation tends to die away very soon. In large auditoriums where surfaces are further apart there are fewer reflections and less loss of energy per second. Reverberation tends to linger, sound seems unpleasant, and speech is difficult to understand.

Acoustic correction for this condition can, however, be overdone, making reverberation time too short. Sound is then intelligible but "dead"—without brilliance or sparkle. There is an ideal reverberation time for every enclosure, according to its size.

Projectionists can identify the general nature of reverberation faults by listening carefully to auditorium sound in comparison with the triple-check suggested previously. Acoustic engineers measure reverberation time with special apparatus, or calculate it from architectural data. Comparison with a table showing what the reverberation time

(*Continued on page 30*)

Here's What Happens in RCA'S New 'Image Orthicon' Pick-Up Tube



This simplified functional drawing of the new RCA Image Orthicon, an ultra-sensitive television camera pick-up tube, shows how the tube's response to the light of a single candle, or even a match, is built up to provide a signal which can reproduce images on home-receiver screens. A light image from the subject (arrow at extreme left) is picked up by the camera lens and focused on the light-sensitive face of the tube, releasing electrons from each of thousands of tiny cells in proportion to the intensity of the light striking it. These electrons are directed on parallel courses from the back of the tube-face to the target, from which each striking electron liberates several more, leaving a pattern of proportionate positive charges on the front of the target. When the back of the target is scanned by the beam from the electron gun in the base of the tube, enough electrons are deposited at each point to neutralize the positive charges, the rest of the beam returning, as indicated, to a series of "electron multiplier" stages or dynodes surrounding the electron gun. After the returning "signal" beam has been multiplied many times, the signal is carried out of the tube to the television broadcast transmitter.

IN THE SPOTLIGHT

By **HARRY SHERMAN**

DEBUNKING the many anti-union myths spreading over the country, particularly the one reflecting upon the democratic spirit of labor unions, becomes a relatively simple matter when the facts about union aims and policies are presented to the public. Labor-hating newspaper columnists, in their eagerness to vent their spleen against any form of organized labor, whether AFL or CIO, seize every opportunity to fill their columns with vitriolic reports about so-called "labor dictators" and "racketeering unions."

Not all unions are perfect—no human institutions are, whether they be large corporations or labor unions. Not all union leaders are above reproach in the conduct of their business, and this applies as well to many leaders in industry and in public life.

Democracy, as we know it in this country, is clearly exemplified in our labor unions. Officers of international unions are elected by the membership or by convention delegates representing the membership. Such elections usually are held annually or biennially. Local unions are chartered by a parent body and they, too, hold annual or biennial elections. Local meetings are held regularly once or twice a month, with occasional special meetings. Members are constantly urged to attend all meetings; full and free expression of views is encouraged. At regular intervals reports are made to the membership on all union matters; majority rule prevails.

Unions provide a democratic framework in the form of a constitution and by-laws which insure basic equal rights for all members. How many of our large corporations offer the same freedom of expression to their stockholders? Certainly not via the outmoded and essentially vicious proxy system now in vogue.

● It takes more than a mere fracture of the shoulder blade to knock out some of our hardy oldtimers. Charlie Schlegel, member of Indianapolis Local No. 30 for more than 30 years and employed as stage manager of the Murat Shrine Temple in that city, is now back on the job after having been incapacitated for several weeks with a shoulder injury. Charlie is a real oldtimer, having served as 4th I. A. vice-president way back in 1913.

● In a recent poll conducted by the New York Central Railroad among thousands of passengers, motion picture entertainment was rated high on the list of suggested improvements for new trains. The showing of pictures on trains would greatly relieve the tedium of long rides and would offset to some extent the stiff competition provided by other means of transportation, notably plane and bus.

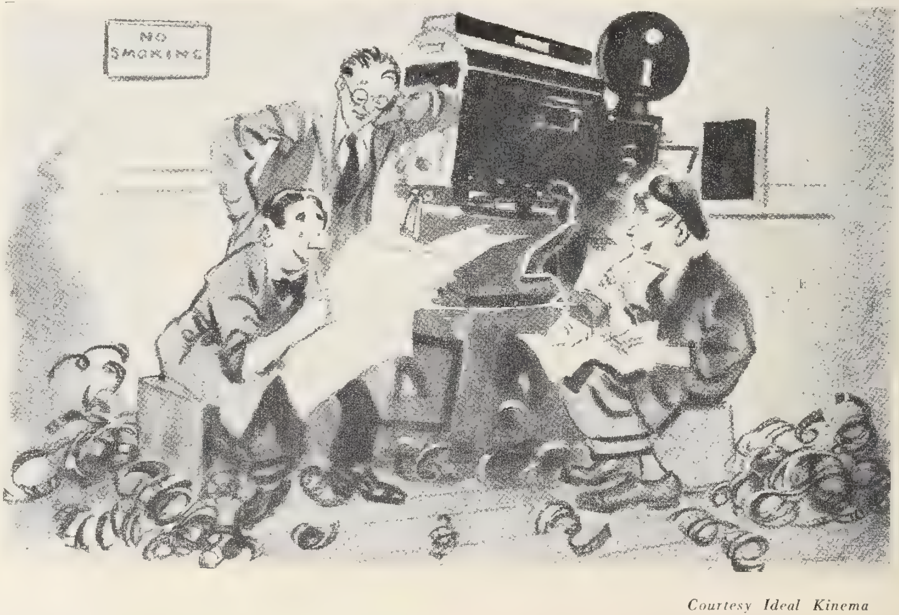
A research committee has been appointed by the railroad company to investigate the applicability of both 16- and 35-mm projection. From reliable sources we learn that railroad officials are giving serious consideration to the matter and are planning to inaugurate this feature in their new rolling stock, probably next Fall.

Union officials have been sounded out on the hiring of union projectionists and it is believed that the two-men-per-train shift asked by the unions is the stumbling block in the negotiations. That problem, too, will be ironed out in due time and the day is not far off when we will see I. A. men running picture shows on all our railroads.

Alert Union officials will act *now* to anticipate any such development in their jurisdictions, thus obviating any future misunderstanding anent manpower and scale requisites. The early bird . . .

● Addressing a group of industry leaders at a recent luncheon, New York City's new license commissioner stated that he planned to draw up a new theatre licensing code. He promised to enforce all sanitary laws so as to give the maximum protection to theatre patrons. Since the commissioner made no mention of enforcing sanitary laws for projection rooms, we respectfully call the attention of Local 306 officials to this omission. The sanitary conditions of too many projection rooms in New York City are little short of disgraceful and constitute a definite occupational hazard.

● The Federal Government has undertaken the study of a guaranteed annual wage plan, which is advocated by many



Courtesy Ideal Kinema

**"Listen to this chaps, it sounds good—
'WANTED, men and boys for celluloid scrap works, good wages, kinema operators preferred.' "
"Do you think we stand a chance, 'Erb?"
"I should think so, with our experience."**

labor unions and some representatives of management. This plan would give workers security of income, maintain purchasing power, and regulate production and employment. Guaranteed annual wage plans are now in operation in certain individual companies and are included in some union contracts. It wouldn't surprise us in the least if this plan were finally adopted by all unions, for as we see it, whether by collective bargaining or by legislation, guaranteed annual wages would help to stabilize industry.

● Thad Barrows, president of Boston Local No. 182, visited the offices of I. P. the other week following a trip to New Haven where he attended the party given in honor of Thomas Shea, newly appointed Assistant International President.

Incidentally, Thad mentioned the death of a former president of the Boston local, W. G. Badger, who moved to Los Angeles in 1929 to regain his health and there joined Local No. 150. Badger had a remarkably keen sense of humor and won many friends through his humorous writings, many of which appeared in the "Sound Ripples" column of the *Los Angeles Citizen*.

● We are glad to learn that more and more local union officials throughout the country are taking cognizance of the fact that rulings on adequate sanitary facilities and proper ventilation for projection rooms must be enforced in order to protect the health of their members. The latest to come to our notice is Frank Kinsora, president of Detroit Local No. 199, who served notice on the exhibitors in his jurisdiction to take immediate steps to correct the unsanitary conditions prevailing in most motion picture projection rooms, or else be prepared to give the projectionists several 15-minute rest periods each shift, during which time the screen will be dark.

As we pointed out in these columns several months ago (*Nov.* 1945, *p.* 19), it would be much cheaper in the long run for theatres to pay a small plumbing bill than it would be to stop the show several times a day for rest periods.

● Carl Danielson "three-war veteran" member of Chicago Local No. 110, died last month at the age of 68 and was buried with full military honors. During his lifetime he had many narrow escapes from death, having participated in the Spanish-American and World Wars I and II. (A brief resume of his exploits appeared in the October 1945 issue, p. 16).

● The reason why Otto Trampe, business agent and secretary for Local No. 164, Milwaukee, Wis., failed to answer our letter last month became clear to us when we learned that together with brother projectionists Johnny Black and Teddy Redding he met with a slight auto accident. All escaped injury but Redding, who suffered a broken wrist.

● We have been informed by I. A. President Walsh that the forthcoming 38th biennial Convention will be held at the Stevens Hotel in Chicago the week beginning July 22.

● Albert Spayd, secretary of Lebanon, Penna., Local No. 554, reports that members John Shultz, Leroy Wagner, Charles Albert, and Clarence Miller have been discharged from the armed forces and are back at their old jobs.

● We take pride in presenting to our readers Lt. William R. Fallon, USNR, and member of Boston Local No. 182. Lt. Fallon was recently commended by Admiral H. K. Hewitt, Commander of the Twelfth Fleet, USN, for "splendid devotion to duty" as Engineer Officer, LST Flotilla Four, prior to, during, and subsequent to the invasion of Normandy on June 6, 1944.

Lt. W. R. Fallon

"As Engineer Officer," reads the commendation, "you were charged with the engineering readiness of a Task Group of thirty-one LSTs. Through your broad experience and ability to anticipate engineering requirements you maintained a high degree of engineering proficiency among the LSTs of the Task Group, thereby contributing substantially to the success of the initial assault. Subsequently, during eleven months of buildup and shuttle operations, your professional skill and initiative were instrumental in quickly returning many damaged and disabled ships to service during crucial phases of the buildup and supply of the allied forces on the continent.

"I commend you for your splendid devotion to duty, efficiency and outstanding professional ability in performance of your duties, which reflect credit upon yourself and the United States Naval Service."

● At last the projectionist has come into his own! When the Associated Press provides national coverage anent a few bouquets for the lowly projectionist, it is indeed something to crow about. You don't believe it? Well, here is the story just as it came off the A. P. ticker:

Most persons who occupy high places get some public recognition for what they do, especially if they do it well. But there are some who get only the brickbats. Among them are the men who toil in tiny hot booths atop the nation's movie houses. The movie projectionist is the man who makes much of America's entertainment possibe. He must be skilled in many lines that most people don't think anything about.

In some of the larger cities, where the theatres are fully modernized, the projection rooms are fitted up with showers and other conveniences, but there is nothing like that in most of the crossroads picture theatres that form the bulk and backbone of the American cinema.

In many cases the projectionist must tussle with old-fashioned arc lights, seeking to maintain a steady intensity. In the smaller theatres, the prints he receives are apt to be worn and torn and patched. He must keep a constant vigil, for when the film breaks, the audience sets up a howl. When everything goes well, the actors sometimes get applause. But they are miles away in Hollywood, already working on another picture. They can't hear it. But nobody ever applauds the lowly projectionist on his lofty perch.

People often wonder, if they think about it at all, how the projectionist knows when to shift from one machine to the other, without letting the changeover show to the audience. Well, it is not a great secret, but it does require a lot of constant watching. Next time you go to the movies, you can see for yourself, if you watch, a tiny black or white dot appearing in the upper right-hand part of the picture. This flashes for a brief second as a warning—then it appears again. At that moment the projectionist steps on a changeover device and one machine goes out while the other one comes on.

It all happens so quickly that the average eye does not detect it. It requires precision and alertness and steadfastness. The motion picture projectionist is a hero in his own realm, only nobody ever pins a medal on him.

● A note from our old friend, Ralph A. Root, Sr., business agent for Local No. 236, Birmingham, Ala., in which he mentions that his son, Ralph, Jr., was obligated at the last local meeting and is working as a projectionist until he enters Georgia Tech next July, sent our thoughts wandering back some 20-odd years ago when Ralph, Sr., and yours truly were a couple of gay young blades. Yes, in those days we hit many a high spot together, and today we look back on them with a feeling of nostalgia. Now that we have reached the grandfather stage (and mighty proud of it, too), we oldtimers have many a hearty laugh recalling our youthful exploits.

DeVRY 4-POSITION MIXER

DeVry Corp. announces a 4-Position Mixer Unit to serve as many as four microphones. With four inputs, four microphones, or a record turntable and three microphones, may be used. With each input having its own volume control, the sound can be balanced from each microphone as desired. If a turntable is used, the music can be faded to permit mike announcements.

ST. LOUIS SERVICE DEAL BY RCA

An agreement for the servicing of sound systems in ten Wehrenberg Theatres in St. Louis and its suburbs has been announced by RCA. Houses covered by the agreements are the Apollo, Melba, Michigan, Cinderella, Virginia, Lemay, Studio, and Southway, in St. Louis; the Savoy, in Ferguson, and the Normandy, in Normandy.

Basic Radio and Television Course

By *M. BERINSKY, E.E.*
MEMBER, INSTITUTE OF RADIO ENGINEERS

XXI—TRANSMITTERS [OSCILLATORS]

THE transmitter block diagram shown in Fig. 1 (designated Fig. 3 in the preceding installment) will now be explained in some detail. This transmitter contains five stages: an oscillator, a driver or buffer amplifier, a power amplifier, a speech amplifier, and a modulator. The oscillator is the part of the transmitter that is responsible for the generation of the carrier wave. A simple oscillator, known as a Hartley type (Fig. 2), is commonly used in many electronic applications. The theory of operation of this type of circuit is as follows:

The battery A heats the filament of the tube, causing it to emit electrons. Battery B puts the plate at a positive potential with respect to the filament, and electrons are thus drawn to the plate. Any minute disturbance in the circuit will cause a change of potential between the grid and plate, resulting in an instantaneous change in the electron flow to the plate.

Because of the high reactance of the choke coil, RFC, the change in plate current does not appear in the B-battery circuit but causes a potential to develop between the plate and filament through the condenser C_2 and the part of the coil L included between C_2 and the filament tap. Since this part of L is magnetically-coupled to the part between the filament tap and the grid condenser, C_3, there is an induced potential between the grid and filament.

This potential acts in such a way as to increase the change in plate current. The process continues, being reinforced by the amplifying properties of the tube, and when the power transferred to the grid circuit from the plate circuit is great enough to overcome the grid-circuit losses, a state of continuous oscillation is reached. The frequency of oscillation is determined by the constants of L and C_1.

The purpose of the grid condenser, C_3, and grid leak, R, is to keep the average potential of the grid negative with respect to the filament. When the instantaneous grid potential is positive, electrons are attracted to the grid and current flows in the grid-filament circuit; this current is unidirectional and

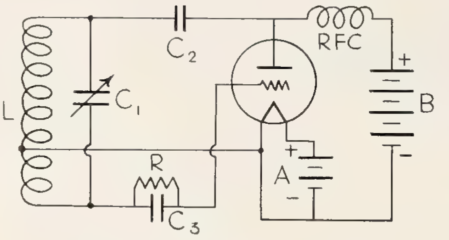


FIGURE 2. ***Hartley oscillator.***

cannot flow through C_3, thus the voltage drop resulting across R is utilized as grid bias. C_3 offers practically no impedance to the flow of r.f. currents. The direction of grid-current flow is such that the grid becomes negative with respect to the filament.

If two condensers in series were substituted for L, and a coil for C_1, another type of circuit known as a Colpitts oscillator would result. A Colpitts oscillator gives somewhat greater voltage output at the high frequencies, but is not quite as stable as the Hartley type.

Armstrong Feedback Oscillator

Figure 3 shows an Armstrong feedback oscillator. This type is used as the local oscillator in super-heterodyne receivers and is the basic part of the regenerative receiver. When the filament of the tube is lighted and plate voltage applied, any small disturbance in the grid circuit will cause a change in the potential of the grid with respect to the filament, thus causing the plate current to change.

Since the plate current flows through L_2, which is inductively-coupled to L_1, a voltage will be induced in L_1. If the two coils are correctly poled, the induced voltage will reinforce the original change in grid potential and the process will repeat itself, being amplified each time by the amplifying properties of the tube, and building up to a continuous oscillation whose amplitude is limited by the tube and circuit characteristics and the tube's operating voltages.

The frequency of the oscillations is determined chiefly by the constants of L_1 and C_1. The grid condenser C_2 and leak R set the operating grid bias, and condenser C_3 by-passes the radio-frequency currents around the source of plate power.

Another popular type of oscillator is known as the tuned-grid, tuned-plate circuit, as seen in Fig. 4. When the filament of the tube is lighted and the plate voltage applied, any small electrical disturbance in the grid circuit will cause a change in the potential of the grid with respect to the filament and thus cause the plate current to change. Since the plate current flows through L_2, the change in current will cause a voltage to be induced in L_2, which

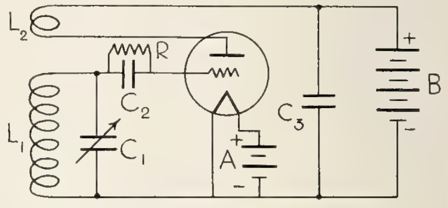


FIGURE 3. ***Armstrong oscillator.***

appears between the plate and filament of the tube, since by-pass condenser C_4 has negligible impedance for radio frequencies.

Because of the amplifying action of the tube, the voltage so induced is larger than the original electrical disturbance which caused it. Because of the electrostatic capacity existing between the grid and plate of the tube, the voltage existing between the plate and filament causes a further voltage to be induced on the grid which reinforces the change caused by the original disturbance. The process repeats itself and a continuous oscillation builds up, the amplitude of oscillation being limited by the tube and circuit constants and the operating voltages.

Grid condenser C_3 and grid leak R determine the operating grid bias. The oscillator frequency is approximately determined by L_1 C_1 and L_2 C_2, both being tuned to nearly the same frequency.

The stability of the oscillators described herein is affected by the circuits which these oscillators feed. In some cases such loading of the oscillator

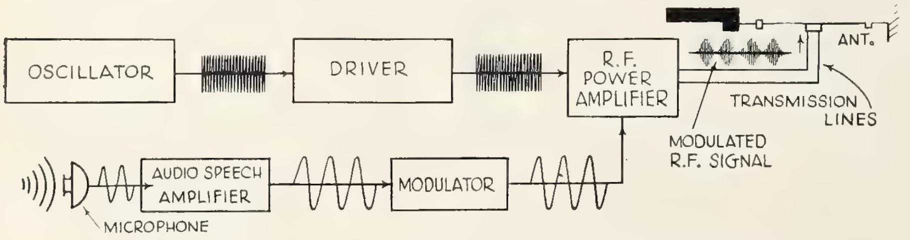


FIGURE 1. ***Block diagram of a typical phone transmitter.***

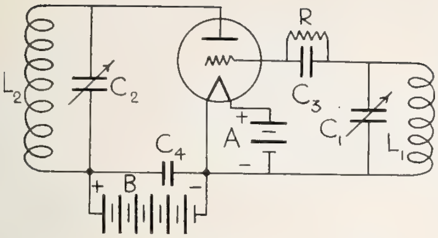


FIGURE 4. ***Tuned-grid, tuned-plate oscillator.***

causes a shift in the oscillator frequency which cannot always be tolerated. The electron-coupled oscillator is not affected to more than a negligible degree by circuit loading. Such a circuit is shown in Fig. 5.

It will be seen that the basic circuit of Fig. 5 is that of a Hartley oscillator and is similar to Fig. 2. The Hartley oscillator is generally used in an electron-coupled circuit.

Electron-Coupled Oscillator

The screen grid in the electron-coupled oscillator acts like a plate and is placed at r. f. ground potential by a condenser which is connected from screen-grid to ground. The output signal appears in the plate circuit because of the coupling between all tube elements by the common electron stream. A radio-frequency choke is placed in the plate circuit. This choke has a high impedance to radio-frequency and will prevent the output signal from leaking off to ground through the power supply. The output is taken from the plate end of this radio-frequency choke.

Because of the shielding between plate and screen-grid inside the tube, the circuit loading at the plate will have only a negligible effect on the oscillator frequency. This action renders the electron-coupled oscillator very stable, and is the reason for its popularity as a frequency standard in signal generators and as a low-cost amateur transmitter.

The frequency stability of an oscillator is generally better at low frequencies than at high frequencies. With the electron-coupled oscillator it is possible to operate the oscillator at a low frequency and use harmonics for the higher frequencies. If the RFC in Fig. 5 were replaced by a coil and variable condenser, it would be possible to tune the output to harmonics of the fundamental frequency. Such an oscillator would be very flexible, especially for amateur radio transmitters where the operator may work on several bands with one transmitter.

The crystal oscillator is by far the most popular at the present time. Oscillator crystals are of quartz and are given special names such as X-cut, Y-cut, AT, etc. These cuts refer to the angle at which the crystal is cut with respect to one of its axes. A crystal has an equivalent circuit which looks like that of a tuned circuit containing resistance, inductance, and capacitance. It also has a very high "Q", which is a desirable feature of a tuned circuit.

Characteristics of Crystals

A crystal is cut to oscillate at a specific frequency and cannot be used at other frequencies unless harmonics are utilized. The frequency at which a crystal will oscillate is determined by the thickness of the cut, the thicker crystals working on lower frequencies. If a crystal is vibrated mechanically, it will create electrical impulses whose frequency depends upon the thickness of the crystal.

X-cut crystals have a negative temperature coefficient of 15 to 25 cycles/megacycle/degree C. The coefficient of Y-cut crystals varies from —20 cycles/megacycle/degree C to 100 cycles.

FEBRUARY QUESTIONS AND CORRECT ANSWERS

1. ***(Q.)*** **What is the purpose of the keys on the octal and octalox tube bases?**
(A.) **To lock the tube in its socket properly.**
2. ***(Q.)*** **How does the length of an antenna vary with the carrier frequency of a transmitter?**
(A.) **The length decreases as the frequency increases.**
3. ***(Q.)*** **Why is a modulator required in a phone transmitter?**
(A.) **To provide a means for varying the carrier amplitude, placing the intelligence on the carrier.**

The frequency and thickness of a crystal are related as shown by the formula:

$$f = \frac{k}{t}$$

where f is the frequency in megacycles, t is thickness of the crystal in thousandths of an inch, and k is a constant equal to 77 for the Y-cut and 112.6 for the X-cut.

Above 10 megacycles the crystal becomes very thin and fragile. If crystal control of an oscillator is desired at frequencies above this value, it is easier to grind the crystal so that it oscillates actively at some harmonic of its natural frequency. The power dissipated by the crystal must be kept to a minimum in order that the crystal does not overheat. Heat will cause a frequency shift and may also cause damage to the crystal.

If the crystal is made to oscillate too strongly, the amplitude of the mechanical vibration will become great enough to crack or puncture the quartz. Safe values

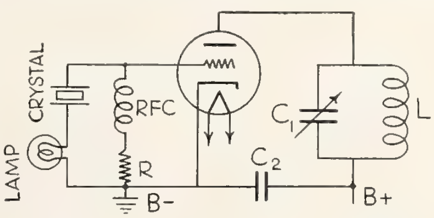


FIGURE 6. ***Triode crystal oscillator.***

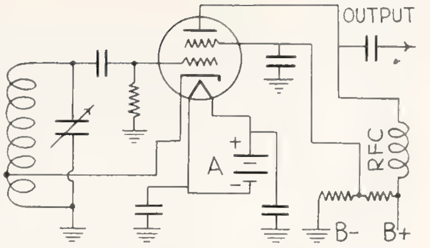


FIGURE 5. ***Electron-coupled oscillator.***

of crystal current vary from less than 50 milliamperes to above 200 milliamperes, depending upon the type of cut used. It is common practice to place a flashlight or radio pilot-light bulb in series with the crystal to indicate excessive current. If the light has a rating smaller than the maximum allowable crystal current, it will act as a fuse and will burn out, opening the circuit in time to prevent damage to the crystal.

Component Unit Requisites

In commercial broadcasting service the crystal is placed in an electrically-heated crystal oven. A thermostat maintains a constant crystal temperature. The crystal oscillator is never turned off, even when the transmitter shuts down. These precautions are necessary if the broadcasting station is to maintain the frequency stability required of it by the FCC.

The crystal holder is a vital part of the crystal oscillator circuit. The crystal is mounted between two electrodes which are a part of the holder, two types of mountings being commonly used. In one type the electrodes are in contact with the surfaces of the crystal; in the other type there is a small air gap between the top electrode and the crystal surface.

It is essential that the metal electrodes which are in contact with the crystal surfaces be ground perfectly flat. The holder acts as a capacity across the crystal, which in turn acts like a tuned circuit. Because of the capacity of the holder, the frequency at which the crystal oscillates will be affected slightly when placed in different types of holders.

When a crystal is to be cut for an exact frequency it should be checked while it is in the holder with which it is to be used in the transmitter. The holder should be designed so as to have good heat-radiating properties. This will help

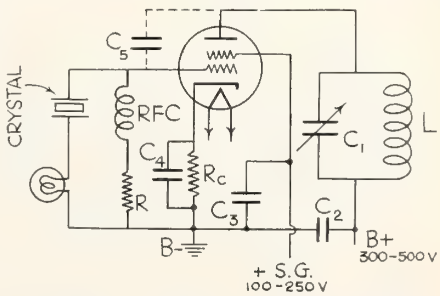


FIGURE 7. ***Tetrode crystal oscillator.***

to minimize frequency drift due to temperature effects.

A typical crystal oscillator circuit (Fig. 6) is built around a triode tube. The theory of operation of this type of oscillator is similar to that of the tuned-grid, tuned-plate circuit. The crystal and its holder act as one tuned circuit, and the plate circuit consisting of L and C_1 acts as the other. Feedback is through the grid-plate capacitance of the tube.

The RFC has a high reactance to the oscillator frequency and prevents the signal from being grounded out through the lower resistance of R. R is called a grid leak and prevents the tube from accumulating a very large negative bias which would cut off plate current and throw the circuit out of oscillation. Typical values of R are from 2,500 ohms to 25,000 ohms, depending upon the type of tube used.

The tuned circuit in the plate side of the tube, consisting of L and C_1, should resonate at about the same frequency as the crystal.

Condenser C_2 places the plate return at RF ground potential. The positive potential for the plate is applied to the terminal marked B+; while the negative end of the power supply is grounded. The bulb which is inserted in series with the crystal acts as a fuse and prevents damage to the crystal if excessive current should flow through it.

One disadvantage of the crystal oscillator is its low r. f. output. This means that a large amount of amplification will be necessary with this type of circuit. Higher oscillator output is possible when tubes having higher power sensitivities than triodes are used. Since tetrodes, pentodes, and beam power tubes fall into this category, they are the ones most often used. The beam power tube is best because of its very high power sensitivity.

Non-Triode Tube Types

Figure 7 shows a circuit containing tubes other than triodes. The theory of operation is similar to that of Fig. 6. It will be seen that a cathode resistor, Rc, is connected in series with the cathode. This circuit provides additional grid bias which, acting in series with the bias developed across the grid leak, R, serves as a safety device. If the circuit for some reason should stop oscillating, the bias developed across R would become zero. This would cause very large plate currents to flow through the tube and, in some cases, would occasion damage.

With the cathode resistor of Fig. 7 a certain amount of negative grid bias will always be available regardless of circuit conditions, since cathode current flows even when the tube is not oscillating. C_4 is known as a cathode by-pass condenser and its purpose is to smooth out the voltage developed across Rc, since grid bias voltage must be pure DC and free from any r. f. variations. Condenser C_3 has a low reactance to r. f. and will by-pass any r. f. on the screen grid to ground. This condenser prevents r. f. from getting into the power supply where it might cause trouble.

The condenser C_5 is very small and is used when a tube does not have sufficient grid-to-plate capacitance to allow the circuit to oscillate. This condenser is never necessary when a triode is used.

The adjustment of a crystal oscillator is accomplished by connecting a plate current milliammeter in series with the B+ lead and tuning the condenser C_1 through resonance. When the circuit is not oscillating the plate current will be steady; but the plate current will dip sharply when resonance is approached. The condenser is tuned for minimum current (maximum dip). Sometimes the condenser is not tuned exactly to resonance because the circuit does not fall out of oscillation easily and is very stable at this point.

A crystal oscillator may fail to function properly due to dirty or defective crystals or holder surfaces, insufficient grid-to-plate tube capacitance, too tight coupling to load, and plate coils and condensers that will not resonate at the crystal frequency.

Oscillators are very important to the motion picture projectionist. They are used widely in radio applications, industrial electronics, as a source of power for the exciter lamp in 16-mm sound projectors, and in some types of phonograph pick-ups (Philco beam of light). A review of a recent article on oscillators which appeared in I. P. would be helpful.[1]

[1] "Introduction to Vacuum Tube Oscillator Circuits," by Leroy Chadbourne, I. P., Dec., 1945, p. 7.

MARCH QUESTIONS

1. Why is the crystal preferred to other types of oscillators?

2. Give one disadvantage of a crystal oscillator.

3. Why is a cathode resistor used in Figure 7?

The answers to these questions will appear in the next issue.

I. A. ELECTIONS

LOCAL NO. 199, DETROIT, MICH.

Frank Kinsora, *pres.;* Gil Light, *vice-pres.;* Roy Ruben, *fin.-sec.;* Joe Sullivan, *cor.-sec.;* Jim Murtagh, *treas.;* Roger M. Kennedy, *bus. rep.;* William Esperti, Walter Craig, Tom O'Tool, *trustees;* Frank Kinsora, Gil Light, Roy Ruben and Jim Murtagh, *del. to I. A. Convention.*

LOCAL NO. 236, BIRMINGHAM, ALA.

J. C. Harper, Sr., *pres.;* Leo Nation, *vice-pres.;* F. E. Walker, *treas.;* J. F. Mankin, *sec.;* R. A. Root, Sr., *bus. rep.;* Carl Jones, *sgt.-at-arms.*

LOCAL NO. 249, DALLAS, TEX.

Guy (Pappy) Luther, *pres.;* C. C. Holt, *vice-pres.;* N. E. Hoyleman, *treas.;* Harvey D. Hill, Jr., *cor.-sec.;* D. P. Holt, *fin.-sec.;* C. E. (Red) Rupard, *bus. rep.;* Harvey D. Hill, Sr., and Earl Medlin, *executive board.*

LOCAL NO. 310, ATLANTIC CITY, N. J.

W. H. (Lou) Clendening, *pres.;* Richard McSweeny, *vice-pres.;* Gus Hilton, *bus. rep.;* Edward J. Oliver, *rec.-sec.;* William Monroe, *fin.-sec.;* George Innis, Frank Bernato, *executive board;* Otto Bertoldi, William Hodge and William Hascke, *trustees.*

LOCAL NO. 554, LEBANON, PENNA.

John Neidig, *pres.;* Edward Deitzler, *vice-pres.;* Albert Spayd, *sec.;* John Shultz, *fin.-sec.;* Raymond Hurst, *bus. rep.;* Earl Small, *treas.;* C. E. Krueger, *executive board;* Pierce Bross, *sgt.-at-arms.*

LOCAL NO. 703, DUBOIS, PENNA.

Clyde Piccirillo, *pres.;* M. Bojalad, *vice-pres.;* J. Bojalad, *sec.;* Chas. Hamberger, *treas.;* Chas. Fleming, *bus. rep.;* Jim Lacy, *sgt.-at-arms.*

LOCAL NO. 735, MT. CLEMENS, MICH.

Dan Defenabugh, *pres.;* Roy Suckling, *vice-pres.;* James Kimmick, *sec.;* George Konath, *treas.;* Bert Penzien, *bus. rep.*

Local 110 Election Swept by 'Achievement' Group

The torturous path traveled by Chicago Local 110 prior to its reassumption of local autonomy two years ago, marked by a general election, no less than its strategic geographical and numerical importance in the I. A., makes the recent biennial election of officers for the former group of more than passing interest to Alliance members generally.

The progressive policies instituted and record of solid accomplishment scored by incumbent officers during the past two years was reflected by the recent election results in which the entire slate of candidates headed by Gene Atkinson was swept into office for another two years by an overwhelming majority.

The decisive nature of the victory scored by the Atkinson "Achievement" slate is indicated in the appended summary wherein appears in parenthesis the number of votes received by the winning candidates out of a total of 605 ballots cast:

Pres.—James J. Gorman (468); vice-pres.—Frank Galluzzo (unanimous); sec.-treas.—Clarence A. Jalas (441).

Bus. Mgr.—Gene Atkinson (512); exec. board—Sam Klugman (497), Charles B. McNeill (485), Art Tuchman (467), and Charles Funk (464). Trustees—Edward H. Schulze, chairman (480), Claude Holmes (474), and George Karg (440). Sgt.-at-Arms—Julius Dickstein (unanimous).

Delegates to I. A. Convention—Gene Atkinson (515), Sam Klugman (496), James J. Gorman (482), Larry Strong (480), William Campbell (454), Ralph Mooney (450), Joe Rossberger (434), and Dominic Zeien (430).

NOVEL GERMAN RECORDING TAPE

The U. S. Army recently reported on a German-developed recording and playback equipment, which they consider superior to any used in Europe or America. The equipment uses a thin tape of a plastic base, specially made by the I. G. Farben, and is a form of dry-processed unplasticized polyvinyl chloride 0.035 mm. thick, on which is coated a layer of iron-oxide mixture .008-.01 mm. thick. The cost is estimated at $3 per roll, which plays for about 20 minutes.

TELECASTS

INDICATIONS that Columbia Broadcasting System intends to press unremittingly its campaign for color as against black-and-white television were forthcoming following recent demonstrations staged for Congressional committees handling radio. Chief opponent of CBS is RCA, which takes the stand that color tele is five years removed from practical utilization.

CBS campaign is now centered in rallying public opinion in support of a demand upon the FCC that the latter "authorize commercial licenses for ultra-high frequency stations to transmit high-definition color television." The ultra-highs reserved for tele are now designated "experimental" by the FCC.

CBS prexy Frank Stanton seized upon the occasion of the Congressional demonstration to get off a strong plug for the color proponents. He told them that the issue is now before the "ultimate court—the public" for decision. Right now public preference is overwhelmingly for color, he added, stating that at a recent showing of CBS color to 90 tele set owners only 12 per cent expressed satisfaction with black-and-white.

CBS affiliate stations are lining up solidly in favor of immediate commercial color tele. Meanwhile RCA is bombarding its affiliates with propaganda in favor of postponing the introduction of color until such time as an all-electronic system is available. The CBS mechanical color system is described by RCA as akin to a system of color reproduction that the motion picture industry tried out and discarded in 1911.

FCC Passes the Buck

Obviously impressed by the CBS color showings, members of the FCC are "playing safe" by stating that any move to commercialize the uhf must be "initiated within the industry" and that insufficient field data has been forthcoming to warrant a stoppage on black-and-white video. Said Chairman Denny of the FCC:

"Proponents of black-and-white television have requested the Commission to guarantee that video will remain on the lower band for at least five years, to preclude the possibility of junking receivers designed to low-frequency reception. We have refused. Also, we have refused to hold up allocation of low-frequency channels even for a year, at the request of high-frequency color advocates, to provide time for standardizing all transmissions in that range. We have left it up to the public to decide which type they shall invest in."

More important here than what was said is what was left unsaid, since Mr. John Q. Public, lacking sufficient technical savvy to determine the relative merits of color vs. black-and-white tele, will be left to shift for himself and, lacking informed direction, will be unable to blame anybody but himself should he incur a money loss as a result of wrong guessing.

* * *

To the question "Are you interested in theatre television or in operating a television station," posed by the magazine "Television," more than 80 per cent of some 350 theatre circuit and individual theatre operators replied "Yes."

Another question, "Have you any plans for theatre television?" evoked the following replies: 58 per cent said they were interested; 32 per cent said they had formulated no definite plans, and 10 per cent did not answer. Some 16 per cent of those who answered said they had made inquiries regarding costs of video equipment.

* * *

The FCC has extended to July 1 the time during which commercial tele stations must operate not less than two hours daily and 28 hours a week. Average station now operates about 18 hours weekly. Extension was granted to give broadcasters a chance to build up their programs.

Incidentally, the DuMont New York City tele station announced that it has already sold to sponsors two-thirds of its available time.

* * *

New York City's three television stations signed off on March 1 in order to reconvert transmitting equipment to the new channels assigned by the FCC. Estimated that 3.500 to 5.000 tele set owners will be affected by the move. The DuMont station returned to the air on March 11, its new transmitter being already attuned to the new channel. Other stations will be off the air for several weeks.

Manufacturers notified all tele set owners of necessity for returning sets, the work to be done by servicemen at a cost ranging from $10 to $25 depending on the size of the set.

* * *

The FCC has granted an application for the largest single construction project it ever considered, an additional link in the proposed 3287-mile coaxial cable to be installed by American Telephone & Telegraph Co. between New York and Los Angeles. The link will cover 1500 miles and the cable will contain eight coaxial units suitable for the transmission of television programs as well as telephone and telegraph channels.

Complete Bell System plan envisages the installation of about 7000 miles of coaxial cable, job to be completed within four years.

* * *

As of Jan. 1 last, there were 19 licensed tele stations in the U. S., 6 of them commercial and 13 operating under experimental licenses. At the same time, reveals the FCC, construction permits have been issued for 3 more commercial and 13 experimental stations. Complete picture of the situation is as follows:

Lic. Comm. Stations	6
Lic. Exp. Stations	13
Lic. Exp. Relay Stations	29
Const. Permits for Comm. Stations	3
Const. Permits for Exp. Stations	13
Comm. Const. Permit Applications	142
Exp. Const. Permit Applications	9
Exp. Relay Const. Permit Applications	20

* * *

Intra-store tele was demonstrated recently at Gertz, Inc., Jamaica, L. I., N. Y. Simplified equipment was used to present merchandising and entertainment features to store's customers. Programs were shown via 6 coaxially-connected receivers strategically located about the store as a demonstration of what can be done to make small-scale, limited-budget tele practical for stores, schools, etc.

* * *

Six tele receiving sets have been installed in branches of the N. Y. Public Library by the Farnsworth and DuMont companies in an experimental educational project. In one branch Farnsworth is installing a complete telecast studio—$200,000 worth of equipment including a camera, control equipment, receiver, lighting, scenery and props. City College of N. Y. will use latter installation as tele course laboratory, and it will also be open for public inspection.

I. P. Subscription Rates To Advance May 1

Effective May 1 next, the subscription rates for INTERNATIONAL PROJECTIONIST will be as follows: For the United States and Possessions—1 year, $2.50; 2 years, $4. For Canada and other foreign countries: 1 year, $3; 2 years, $5.

This advance in rates has been made necessary by an increase of more than 36% in mechanical production costs alone during the last two-year period. Previous cost inceases had been absorbed by I. P., the subscription price of which has been held constant for 15 years.

New and renewal subscriptions bearing a postmark not later than May 1 will be accepted at current rates.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

ON the vertical drive shaft of the Century projector there is a collar #CL-G24 which is secured to the shaft by means of two small set screws. During the course of time these set screws become loosened, allowing the entire vertical shaft assembly to drop down which will cause damage to the teeth on the GR-96 gear. This gear is located just below the ball bearing in the center of the vertical shaft. A few seconds time in checking these set screws may avoid a costly breakdown. All projectionists and service inspectors should check this condition frequently from the standpoint of safety.—Bob Amos, *RCA.*

Defective Coupling Capacitor

Supplementing the information of F. M. Walls, RCA, in the June, 1945, issue of I. P., if the D-95309, 0.1 mfd. coupling capacitor is defective, it can cause a series of "pops" at varying intervals. If the output of the 49 amplifier drops, this capacitor should be suspect.—C. B. Winn, *RCA.*

Watch Filaments on 80 & 83 Tubes

Have avoided considerable trouble on RCA PG-90 equipment (MI-4256 amplifier) by asking projectionist to watch the filaments on 80 and 83 tubes. Normally the tubes are closed in and have a tendency to flash-over and short when turned on. If the cover is put on upside down, the filaments may be seen when standing in front of amplifier.—R. D. Barry, *Altec.*

Serviceman-Projectionists Relations

Never go in a projection room unless the projectionist is present. If he is not available and time does not permit and the theatre does not have a union projectionist, insist on the manager going with you or detailing his assistant to go with you.

Never be the last one to leave the projection room.

Never leave the theatre before the show starts and the projectionist has changed over to the second machine.

Always ask the projectionist if he has turned off everything before leaving, if you service early and leave the projection room before the show starts. They usually turn off everything late at night and depend on pilot lights, etc., to see that things are off; in the daytime these do not show plainly.—C. L. Swinney, *RCA.*

Simple Projection Formulae

Lacking one of the rather common projection charts showing size of image on the screen at different projection distances with lenses of various focal length, the projectionist can readily solve any problem involving "throw," picture width and height, and focal length by utilizing the following simple formulae:

Focal Length:

$$\text{F. L.} = \frac{.825 \times \text{Projection Distance (in ft.)}}{\text{Width of Picture (in ft.)}}$$

Picture Width:

$$\text{Width} = \frac{.825 \times \text{Projection Distance (in ft.)}}{\text{Focal Length of Lens (in inches)}}$$

To Determine "Throw":

Throw = 1.24 x Picture Width (in ft.) x F. L. of Lens (in inches).

The height of the picture is simply equal to the width of the picture multiplied by .73.

These formulae, of course, apply only to the standard 35-mm aperture of .825″ x .6″ dimensions; however, by substituting the actual width of any other objective for .825—which is the width of the 35-mm picture aperture—they will be found accurate for all practical usage. —Harman I. Moseley, *Atlanta, Ga.*

Type 45T Rec-to-Lite Unit

Excessive flicker was traced to the method of making connection to the tube sockets of this type rectifier. As manufactured, the shell and center contact was bolted to bakelite mounting by passing bolt from the top through the shell, the washer and lock washer being used on the bottom. This was pulled up tightly.

The connecting wire was then soldered into the connecting lug, which was placed on bolt on the first nut and then secured with a second nut. No washer was used. In tightening the second nut, the wire was placed under tension which, in use, backed the nut off a fraction of a turn. The consequent increase in resistance caused enough voltage drop to result in unbalance.

The condition could probably be corrected by using a washer and lock washer. However, I reversed the bolt, placing the nut on top where it is accessible for tightening, if necessary.

This step will not eliminate all flicker, but it is worth trying in instances of excessive or intermittent flicker.—H. J. Brown, *Altec.*

Mounting Box-Type Horn Baffles

In the case of small baffles of the box type for mounting on walls, etc., there seems to have been no provision made for hanging or mounting these plywood baffles. In a recent installation of these where they were in easy reach of people, with resultant damage, I found the following method entirely satisfactory even for ceiling mounting:

Conduit straps of the one-hole type were placed two on a side of the baffles; holes of proper size to take the "hook" end of the strap were bored in the side of baffle next to the wall on which the baffle is to be mounted, and far enough from back edge of the baffle to cause the baffle to be pulled tightly against the wall when each toggle bolt is tightened.—Omer Wible, *RCA.*

Tube-Testing Time-Saver

While this idea is not new or original, I mention it as a reminder where working time before show starting is limited to a few minutes:

First, remove all rectifier tubes from amplifier, then turn the system ON. In this manner all tubes left in the system

are pre-heated and can be tested immediately without the usual 30 seconds or more warm-up period.—R. H. Bisbee, *RCA*.

Adjusting W. E. 211 Optical

In checking and adjusting opticals in 211 heads, use a piece of tissue or translucent paper over the prism, which makes the image quite visible.—W. H. Howard, *RCA*.

Adjusting Exciter Lamps

In adjusting exciter lamps, I have found that from one to two db gain can be obtained if adjustment is done using the 300-cycle film and output meter. This exciter and adjustment can best be done just before using 300-cycle film to balance outputs.—Nelson Spock, *RCA*.

Simplex Sound System

It has been found that inactive or low values of electrolytic capacitors C5, C6, C7 or C8 in the AM-101 amplifier were responsible for a low-frequency thump in making a changeover.—F. H. Harris, *RCA*.

Balancing 845 Power Tubes in MI-4255 Power Amplifier

Many theatres have Weston volt-ammeters formerly used with W. E. equipment to test batteries. This meter can be used to balance the 845's in case of developed hum, and often prevents an outage. Use the 0.06 MA series call in connection with a standard plug. Good tubes will balance at about 0.04 MA.—R. H. Bisbee, *RCA*.

Lining Up Projector Aperture Plane

When installing a new screen at a theatre, it is quite difficult to line up the plane of the screen with the plane of aperture for the least amount of Keystone effect. A simple way to accomplish this is to place a thin razor blade, through which is perforated a design or words, in the aperture. Throw this image on the screen and focus.

It will be noticed that when the image on the screen is fuzzy on the left side, the right side will be in focus; when the top part of screen is in focus, the lower side will be fuzzy. For best results, tilt the screen so as to bring its surface parallel to the surface of the razor blade.—S. S. Lebow, *RCA*.

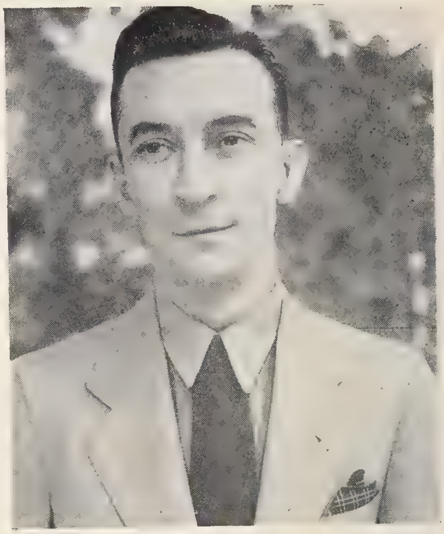
Fusing W. E. 43 Amplifiers

A. W. E. 43-A amplifier which had been modified for power increase and also had a ½-amp. capacitor fuse caused considerable trouble every time a section of the filter shorted by blowing the main amplifier fuse instead of the ½-amp. capacitor fuse. This condition had existed for some time, as a 6-amp. fuse was found in the line to the plate transformer.

The following has been tried and has rendered satisfaction for some months:

Six fuse mountings were mounted on a bakelite plate and installed in the back of the case on the bottom. The filters were connected in groups of 3 mfd. and fused with ¼-amp. fuses. A No. 23946 fusetron was installed in the line to plate transformer.—K. E. Stephenson, *RCA*.

Presenting: Charles F. Wheeler



ABILITY, energy and loyalty to his craft and his industry are the distinguishing characteristics of Charlie Wheeler, who brags about his residence in Upstate New York with as much gusto as do the boys who reside below the Mason and Dixon Line, suh. To add the word "honesty" to his list of qualities would be superfluous, because everytime someone is elected to the office of Secretary-Treasurer it turns out to be Charlie.

Paragon Wheeler has occupied this post in his own Geneva, N. Y., Local 108 since December, 1931, and has filled the same job for the N. Y. State Association of Projectionists since 1943.

Speaking of debits and credits, as we were, nobody has yet calculated the projectionist craft's indebtedness to the Society of Ex-Ushers, and it probably would be well to let the job go undone. Charlie is one of the hundreds of former aisle-pounders who eventually sought the comparative safety of the projection room.

The Wheeler saga began in Clyde, N. Y., back in 1906, when Charlie was born, naturally. Lying like hell, at 13 years of age he landed a job as night usher in the one-projector local theatre. Wage: 25 cents nightly. But, as Charlie explains the catch in the setup:

"During and after the seating of the 300 customers for which seats were available, I streaked up to the projection room (?) to help the 'operator' remove the reel and thread up the next one. I loved this chore at first, but my joy must have been highly infectious, because as soon as the 'operator' discovered I could thread the projector and keep the show going, he retired to his bunk for the rest of the evening. Of course, the ushering angle caught hell, but it gave me my start in the craft. It's an ill wind . . ."

Upon graduating from high school Charlie was promoted to "operator" at a wage of $1 nightly. Shortly thereafter a new theatre

was erected and Charlie (by this time a "projectionist") landed the job. After a year he made the circuit from Clyde, to Bath, through Corning, to Geneva and Local 108.

Mons. Wheeler is pretty puffy about Local 108, pointing out that this group of only ten members, working as a unit, keep the Union ball rolling and, without any special assessment, have bought $800 worth of War Bonds *for the Local*, besides contributing to all worthwhile local charities.

State Association Prime Interest

Another of Charlie's pet interests is the N. Y. State Association of Projectionists, which unique organization has for many years been of inestimable aid to I. A. projectionist locals within the State. Excerpt from Wheeler lyricism thereon:

"The N. Y. State Association of Projectionists is one of the best things that ever happened to the craft in our area. When representatives from all N. Y. State projectionist locals get together we chew up *all* pertinent topics and tab every development that bears on the welfare of all. No 'fast ones' can be pulled on the craft, for example, in Yonkers without becoming known almost immediately in the Buffalo area, over 400 miles away, and in all way stations. Also, we follow technical developments and industry trends closely.

"Of course, none of us can mention the Association without thinking of Glenn Humphrey, for many years a member of Utica Local 337, who was one of the founders and whom it was our great misfortune to lose through death during the past year. Glenn did a lot for us and we shan't forget him."

Amen, say we; and it looks as though the Association will continue to thrive with such men as Charlie Wheeler giving unstintedly of their time and effort.

Oh, yes, lest we forget: Charlie is an amateur railroader, with a complete track layout in the attic of his home, whence he plans to flee when his four-year-old son is old enough to no longer take his guff.

$360,000 to Chicago Theatre in Distrib. Conspiracy

In a decision fraught with great significance to the motion picture industry as a whole, the U. S. Supreme Court, by a 7-1 decision, awarded the Jackson Park Theatre of Chicago $360,000 damages from the major film distributors. The theatre proved damages of $120,000 as a result of alleged discriminatory practices by the distributors, which figure was trebled under the provisions of the anti-trust law.

The decision is certain to exert a profound effect upon the ultimate outcome of the equity suit now pending in New York in which the Government is asking that producers and distributors divest themselves of their theatre holdings.

Find Conspiracy Plain

Basis of the Jackson Park complaint was that independents in Chicago were prevented by the conspiracy from getting early runs. The distribs. did not assail the original verdict insofar as it found evidence of conspiracy. The sole question for decision was whether the evidence of damage was sufficient to support the verdict. The court decided it was.

Upon the evidence in this case, said the Supreme Court, it is indisputable that the jury could have found that during the period in question a first or prior-run theatre possessed competitive advantages over later-run theatres because of its greater capacity to attract patronage to pictures which had not been shown elsewhere, and its ability to charge higher admission prices than subsequent-run theatres, and that other things being equal the establishment of the discriminatory release system was damaging to the petitioners who were relegated by it to a playing position inferior to that of their competitors.

In addition, the Court found clear proof that a conspiracy to maintain prices in the subsequent-runs was also part of the general picture. The release system and the price-fixing "were each an integral part of an unlawful conspiracy to give to the Loop theatres the advantages of a first-run protected from low-price competition."

Some observers view the decision as a prelude to a nation-wide overhauling of film distribution policies, notably with respect to clearances. Subsequent-run theatres, a vast majority of the whole, are jubilant over the decision.

Projector Maintenance Tips

By *ARTHUR E. MEYER*

MANAGER, PROJECTION EQUIPMENT DIV., NATIONAL-SIMPLEX-BLUDWORTH, INC.

IN A PREVIOUS article* the writer suggested a number of principles deserving of important consideration in judging the ability of a projector to deliver good screen results. The appended discussion will be devoted to those factors that apply to the "maintenance quality" of a mechanism, to the ease and economy with which it can be kept in tip-top operating condition.

The reference base will be the Simplex E-7; however, the principles referred to are basic to the question of maintaining all projectors.

Since it is his chief duty to operate his equipment and only secondarily to repair it, the projectionist spends by far the greater part of his time at operation. He cannot, therefore, accumulate the kind of experience in repair work that belongs to a man who spends all his time at repairing projector heads. Similarly, the projectionist, as a rule, does not have —and economically, he should not have — expensive special tools that he may never need to use more than once in a few years.

Consequently, expert servicing assistance should be available to the projectionist whenever, after some years of use, more than superficial repairs may be needed.

Repair vs. Rebuilding

Another factor is that the most economical maintenance consists of timely repairs made in the projection room, rather than installation of a rental head and complete rebuilding of the projector at the factory. Factory rebuilding is an expensive procedure that may become necessary after a great many years of operation, but the need for it should be minimized. There are trained men in every projection room who, under normal circumstances, ought to make all needed repairs.

A rather large number of design features are incorporated in the Simplex E-7 with a view to permitting projection room repairs in preference to factory rebuilding. For example, gears revolve on their shafts, the shafts are stationary and do not revolve in bushings in the main frame. Replacing a gear or shaft is a simple projection room job; rebushing a main frame is not. Materials, also, are so chosen and so distributed as to place the burden of wear primarily at the most accessible locations.

A third factor in good maintenance quality is that repairs should not be made unnecessarily expensive by the nature of the design of the mechanism. Unit design minimizes the cost of repairs by limiting the purchase of replacement parts to those that actually need replacing. This important principle can most easily be clarified and illustrated by referring again to the gears mentioned previously. They are replaced as gears—as single units. Not as gear-and-shaft combinations. Not as gear-and-shaft-and-bearing combinations (which bearings may be more or less expensive). Not as gear-shaft-bearing-and-bushing combinations (which may require elaborate and expensive rebushing). Simply as gears. The worn gear is taken off the shaft; a new one is put on the shaft. There is nothing else to buy.

If the stationary stud in its turn becomes badly worn, it also is replaced as a single unit. The gear is taken off, the stationary shaft is taken out of the main frame and a new one bolted in, and the gear (the old one, if it is still good) is put back.

Similarly, the oblique gear comes off

* I.P. for February, 1946, p. 16.

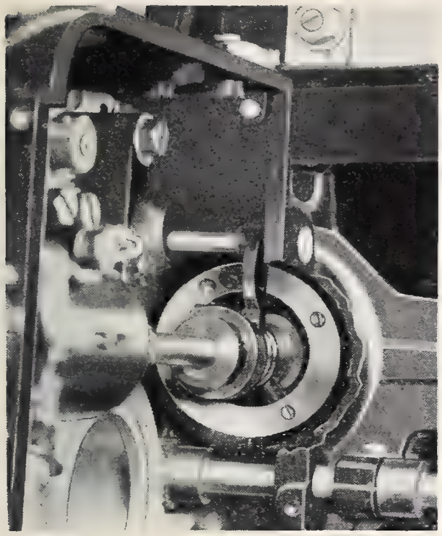


FIGURE 1

the oblique shaft for replacement; the shutter gear can be taken off the shutter shaft; it is not necessary to replace those shafts because their gears have become worn. Likewise, the fire shutter can be replaced as a unit, without replacement of other parts of the E-7 fire shutter mechanism.

Noisy Mechanisms

This general principle of unit construction is followed throughout the Simplex E-7 to the utmost extent practicable. In consequence, repairs sometimes take a little more time, but the cost of the new part is limited to the cost of the one that has to be replaced: there is no need to buy several others also because of a compound type of design and construction whereby worn items cannot be separated from others that are perfectly good.

In any kind of machine it is an important principle of maintenance quality that little troubles should give evidence of their existence before they grow to be big ones. In a projector this is particularly necessary. Serious troubles in a projector not only mean greater repair cost, but can also impose the additional, very drastic expense of a prolonged breakdown in the show.

Therefore it is very vital that a projector run *quietly*. If there be any needless noise, warnings may be masked and lost; and important and serious trouble can then appear unexpectedly. All other reasons aside, a quiet mechanism is the one least likely to produce unexpected trouble.

Silence in the operation of the Simplex E-7 is promoted by a number of design features. Notable among them is the ring-type construction of the governor, illustrated in Fig. 1. It can never chatter, since there are no flyweights to chatter. The ring assumes a more or less acute angle with the shaft; that is the governing action. With flyweights, the toggles on which the weights are mounted assume different angles with respect to the shaft, according as the weights move out or come closer. But the weights, unlike the ring, make a noise about it; the ring action is totally silent.

Maintenance Tools

The hunting-type gearing and the shockproof gear, described in a previous article, are among the other features that promote quiet performance and would be used for that purpose alone even if they did not also have a still higher value in minimizing vibration.

Another point about maintenance, very important under actual projection room conditions, is the widespread lack of proper maintenance tools. It is an unfortunate fact that most projection rooms are poorly supplied with tools. This shouldn't be the case, but it is; and a practical mechanism has to be serviced in projection rooms as they are, not as they ideally ought to be.

The six nuts shown in Fig. 2 are hexagonal and therefore adapted to a socket wrench—provided the projection room

has such a wrench to fit them. But they are also slotted to receive a screwdriver. If the most desirable tool isn't available, the mechanism is still so made that the next best one can be used satisfactorily.

Throughout the projector the same general principle has been applied. Nowhere is any special type of screwdriver needed, only the common kind. Wherever feasible, the necessity for any tool at all has been eliminted by substituting knurled thumbscrews. While special tools and devices are sometimes indispensable, need for their use has been minimized as far as possible in the designing of the projector.

Most things that have to be done on the E-7 mechanism can be done with tools the most poorly equipped theatre will have on hand: two or three common screwdrivers of different sizes and a pair of pliers.

When a repair is finished, it should be *complete*. The practice of doing maintenance work in the theatre instead of sending the projector to the factory to be rebuilt would not be economical if it resulted in sacrifice of performance quality. The whole idea is that no matter how many years of service the head has had, or how often it has been repaired, it should still produce the same fine screen image it did when new.

This is where factory production to accurate tolerances becomes utterly essential. If the repair made by the projectionist is to have the effect of restoring quality performance, the new parts he installs must be absolutely right in dimensions, not just *nearly right*.

The only way to make parts with perfect certainty that they will be exactly right is to make them to measurement. How fine the measurement must be is a matter of the individual part. If a certain replacement part can produce ideal screen results when machined to an accuracy of 1/100th inch, that is the tolerance to which it should be made; if it needs an accuracy of 1/10,000th inch, then it must be machined to a ten-thousandth.

The slightest compromise in this matter simply means that when the projectionist finished his repair work, he would not get a good screen image. He would have done a poor job through no fault of his own.

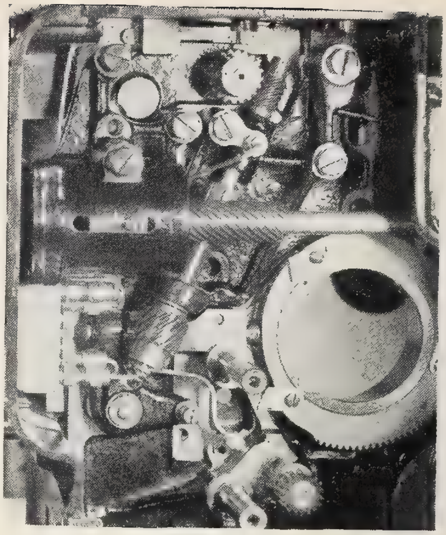


FIGURE 2

NEW SIMPLEX PARTS BOOK BY NATIONAL THEATRE SUPPLY

A new parts book, designed to enable the ordering of Simplex E-7 replacement parts with ease and accuracy, has just been issued by National Theatre Supply, exclusive Simplex distributors. A unique feature of the new book is the use of the modern illustrative technique known as the "exploded view" by means of which each part may be clearly seen in relation to its associated units in each assembly.

In the preface to the book, the company states: "In planning this book we had only *one* objective—to enable you to order replacement parts quickly and accurately, avoiding the costly, time-consuming errors which often result in interrupted performance and lost revenue. With this book as a guide, ordering genuine Simplex parts becomes as simple as A-B-C. A—Locate the part you want in the illustration. B—Jot down the part number. C—Order from your nearest National branch."

In addition to Simplex E-7, similar books covering both the Simplex Regular and Simplex Super will shortly be issued.

RCA SERVICE CO. STRENGTHENS FIELD SUPERVISORY FORCE

Appointment of field service supervisors in several districts by RCA Service Co. has been announced by E. C. Cahill, president. New supervisors and their territories are: J. W. Watson, New York; C. L. Swinney, Atlanta; H. E. Frisbie, Cleveland; E. T. Brown, Chicago; E. D. Van Duyne, Kansas City; S. E. Baker, Dallas; R. E. McKinstry, San Francisco; H. M. Madison, Los Angeles, and A. S. Riley, New Orleans.

Most of these men have been connected with the theatre industry since the early days of sound pictures, and during the war they served in the company's Government Group in special activities for the Navy on radar, sonar, battle announce and similar installations. Many saw overseas service.

The supervisors will assist in placing the latest technical knowledge and developments in the hands of the field forces for prompt application to field service work. In addition, the experience of these experts in all phases of sound and electronics is made available wherever required.

SMPE Launches Vital Expansion Program

THE Society of Motion Picture Engineers has launched an immediate expansion program which will permit a more extensive service to all branches of the industry, a corresponding increase in staff personnel and the leasing of larger quarters in the Hotel Pennsylvania, New York City.

The expansion was decided upon at an important meeting of ranking SMPE executives in New York City recently, and, according to President Don Hyndman, is made possible in part by increased financial support from both major and independent producers, as well as other industry units including leading manufacturers, in recognition of the SMPE as the logical technical fact-finding body and of the increasing number of essential projects requiring immediate attention.

President Hyndman outlined a five-point program of new engineering projects as follows:

Video-Movie Relationship

1—Problems and practices directly related to production, distribution and exhibition.

2—Relation of television to motion pictures.

3—Standardization procedures that will bring greater efficiencies and economies in production, distribution and exhibition.

4—Supervision of world-wide standardizations to facilitate international distribution and exhibition of American films.

5—Correlation and assembling of essential reference books on production, distribution, exhibition, theatre construction, television and other subjects and practices relating to motion pictures.

Point two of the aforementioned program is fraught with great significance to the future well-being of the motion picture industry, and represents the first comprehensive effort to determine the exact relation of the video art to motion pictures.

New personnel to be added will include an engineering secretary, a staff engineer, a technical librarian, a technical stenographer, and additional clerical help. A considerable increase in membership is anticipated on the basis of greatly expanded interest in Society affairs as evidenced by the attendance of more than 400 at the regular monthly meetings.

The various technical committees of the SMPE will be enlarged to correlate industry research and experimentation aimed at improvements in cinematography, process photography, screen brightness, color, preservation of film, projection, theatre design, conservation of equipment and other related matters. Commercial, industrial and other 16-mm films will also receive close attention.

COMMON ACOUSTIC FAULTS

(*Continued from page* 15)

should be in a theatre of a given size indicates the changes needed.

Almost always these changes take the form of switching some of the surface materials for others of different sound absorbing power. (In new construction or extensive reconstruction, consultants may increase the number of sound reflections per second, or break up and dissipate the sound waves, by giving the surfaces special angles, shapes, or deep recesses. That method, however, is rarely used in theatre correction, which is almost completely dependent upon correct use of sound absorption.

Absorption Coefficients

If a theatre is reverberant, indicating that more absorption is needed, experts should be called in to determine the exact degree of correction.

Expert knowledge is cheaper than the trial-and-error method where the large surfaces of a theatre interior are involved. Experience is needed as well as mathematics. *Theoretically* it doesn't matter what surface of the enclosure is made more or less absorbing: the location of the absorbing material doesn't fit at all into the equation commonly used. In actual theatre practice, however, it is found that location sometimes makes a very considerable difference, thus both experience and expert knowledge are important if the rather expensive work of acoustical correction is to be done at reasonable cost and yet give the desired results.

Absorption can be added in either of two ways: by increasing the area to which absorbing material is applied, or by applying over the same area a material of greater absorbing power.

Absorbing power is called the "coefficient of absorption." Since an open window reflects no sound—the sound just goes out—a material that reflected no sound because its absorption was perfect would be said to have the same absorption coefficient as an open window. An open window one foot square is said to have an absorption of 1.000. One square foot of concrete surface has an absorption coefficient of .015. An artificial stone akoustolith has an absorption coefficient of .36. Lengthy tables have been compiled, covering every material likely to be used in a theatre, and suppliers of sound absorbing materials will readily give the figures for their products.

However, the absorption coefficient of a material will not be the same at every frequency. The figures just cited are based on measurements made at a frequency of 512 cycles. A theatre may have too much reverberation at one frequency and too little at another. In selecting materials the acoustical adviser must take into account their coefficients of absorption at the frequencies he wishes to encompass.

Another point: some materials can never be painted or even effectively cleaned without injuring their acoustical properties. Others (such as monks' cloth or velour) can readily be cleaned. Some materials can be painted with special "acoustic paints" made for the purpose, but even so there will be some sacrifice in performances.

Cost of upkeep, or sacrifice of appearance or performance with the passage of time, are therefore among the factors that must be considered in deciding on acoustic treatment.

Some of the details just mentioned are included here only as matters of general interest, so that projectionists will know what the acoustic consultant is talking about. In practical theatre work the relation of the projectionist to this aspect of acoustics is largely limited to being able to recognize that a given trouble is caused by too much or too little reverberation and not by the apparatus, and reporting to that effect to the manager. There are, however, a few things he can do to help.

Equipment Adjustments

Special types of reverberation trouble can be partially compensated for by adjustments in the sound apparatus. A mild case of too much reverberation (too long a reverberation time) can be overcome simply by always keeping the volume down to the lowest point consistent with audience intelligibility. Very mild cases can also be helped by pointing the speakers more directly at the audience, which is an excellent absorber. The average person (who, of course, presents a surface area of more than one square foot) has an absorption coefficient of 4.7.

Since the coefficient of absorption of almost any surface varies at different frequencies, there are special cases of reverberation troubles at various frequency levels. In such cases the projectionist can *sometimes* save the great cost of acoustic treatment by careful adjustment of his tone controls or equalizers.

If reverberation is excessive when the theatre is empty or partly so, but sound is satisfactory with a large audience, the trouble can be eliminated by installing—when they become available—the kind of theatre chairs that are built to have the same coefficient of absorption as an average human being. Absorption at that chair will be about the same, whether it is occupied or not, and acoustic conditions will therefore change very little with changes in audience size.

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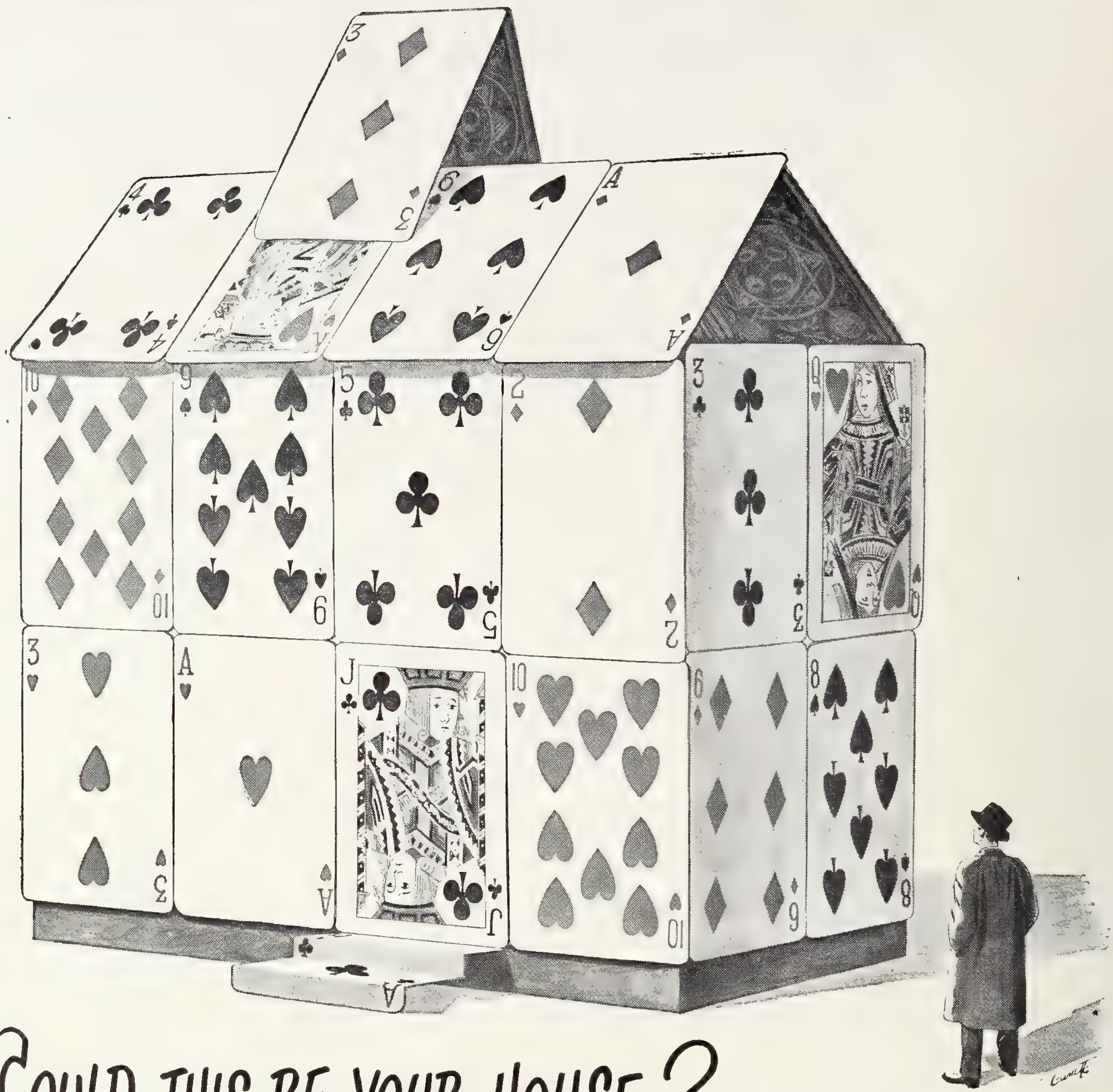

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MONTHLY CHAT

THE first fruits of intensive experimental work involving drastic changes in production and reproduction technical standards are at hand in two shorts, *of 50-mm width*, recently completed through the joint efforts of 20th Fox, Western Electric and Eastman Kodak. This enterprise, coupled with reliable reports that serious consideration is being given to utilizing 20-mm prints, is encouraging evidence that some sector of the industry is alive to the box-office threat posed by television, 16-mm "theatre circuits" and various "wildcat" schemes for purveying entertainment.

Now, 50-mm film has undoubted advantages over the 35-mm standard stock, most important of which are the increased area of action (although we have grave doubts anent any gain in purely dramatic content) and greater leeway in handling multiple soundtracks. The 20-mm width appeals to us not at all for use in existing theatre structures.

It follows, of course, that the use of 50-mm prints would entail the conversion of every piece of film-handling equipment —from camera to projector—now in use in the professional film field. Assuming that the industry should commit itself to an expenditure of such astronomical proportions, which we doubt, we fail to see any advantages to be derived therefrom.

We see nothing wrong with the screen *size* in an overwhelming majority of existing theatres; and previous experiments with wide-gauge film in even the largest film houses (notably the Spoor pictures in the Roxy Theatre, N. Y. City) impressed us as, at best, an interesting novelty. Frankly, we thought that the Spoor pictures offered too large a screen image for the eye to encompass.

No, the answer to competition is not to be found in either larger or smaller film stock with comparable changes in theatre screen size. What is needed to properly evaluate the industry's position in a changing entertainment world, apart from operating at peak efficiency with existing equipment, is intensive and prolonged study of consumer preference in entertainment and a frank analysis of how much of what kind of product will be available to the theatre field.

One vitally important question in any such analysis is that bearing on the trend of television development: Will it boil down to essentially home entertainment, or will there be a sharp cleavage between productions for the home and those for the theatre?

We repeat here our firm conviction that if the best in entertainment is to be made available to the home, for free, there is no logical reason why anybody should stretch a shoelace to pay his way into the corner movie house. Nobody seems to know the answer to this one, although complacent movie men confidently assert that the video art will break its back before it solves the problem of an 18-hour program daily.

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Notes on Rectifier Performance

By *L. W. REINKEN*

CHIEF ENGINEER, GREEN ELECTRIC COMPANY

The accompanying data on rectifier applications, while not specifically related to the motion picture projection field, will serve to broaden the base of projectionist understanding of power supply sources. Subsequent articles by the author, an acknowledged authority in his field, will bear directly upon the motion picture projection process.

ALL tube rectifiers, excepting specialized "cold cathode" types, require filament supply voltage, usually from a separate transformer. In complex circuits—such as the three-phase bridge—as many as four or six separate filament supplies are required. The amount of power used for heating the filaments is generally small compared to the DC rating of the complete rectifier equipment, and does not seriously affect the full-load efficiency.

Many industrial rectifier tubes require that the filament should be permitted to reach normal operating temperature before voltage is applied to the plate. This delay (30 seconds to 4 minutes, depending upon the type of tube) can be left to the user's discretion, or can be made automatic by using a TDR (time delay relay). The TDR prevents the plate circuit from being closed until the desired filament heating period has elapsed.

A fact peculiar to mercury-vapor or gas-filled rectifier tubes is that the voltage drop, or potential difference, between the plate and filament is substantially constant and practically independent both of the current through the tube and the value of the AC supply voltage—up to the point where the tube is destroyed. This voltage drop is only about 8 to 13 volts, and is negligible in rectifier equipment delivering high DC voltage.

From the preceding notes on voltage drop and filament supply, it is obvious that a high-voltage rectifier tube equipment operating anywhere near the rated tube current, can be very efficient. This applies particularly to three-phase equipment, although properly designed single-phase rectifiers are satisfactorily efficient also.

The life of rectifier tubes, like that of most electrical equipment, is shortened by continued overload operation. Most industrial rectifier tubes will withstand considerable overload for the short period of time required to trip an input circuit breaker, or an overload relay or fuse.

Most rectifier tubes operate satisfactorily over a wide range of ambient temperature, and only for unusual conditions and in large capacity units is it necessary to incorporate artificial cooling by air fans or water pumps.

Tube Life and Replacement

The majority of rectifier tubes are guaranteed by the manufacturer to have a minimum life of 2,000 hours of use, or usually twelve months, and most tubes have a life expectancy considerably greater than this. Small, low-voltage tubes of comparatively high current rating (such as the argon-filled tubes widely used in home battery chargers at one time) have a life of about 1,000 hours, but these tubes are cheap to replace and are available everywhere. In general, tube replacement cost is not important.

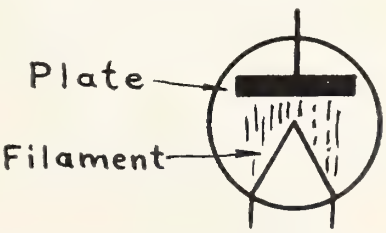
In those applications where tube failure might be dangerous or embarrassing, a running time meter should be incorporated in the rectifier equipment, and a tube replacement schedule set up.

The selenium rectifier was developed in Europe about 1928, and introduced here some years later. Its detailed construction has been described many times. Briefly, a selenium rectifier assembly, or "stack," consists of a number of metal rectifier plates assembled on a common mounting stud, interconnected as required, and, usually, finished with a moisture-proof, corrosion-resistant lacquer.

The maximum AC voltage which may be applied to a single selenium rectifier plate, although higher than that of other metal rectifiers, is considerably less than that which may be applied to tube rectifiers. For higher voltages, more plates must be connected in series, which proportionately increases the size and cost of the rectifier assembly.

Theoretically, there is no technical limit to the maximum voltage obtainable from selenium rectifiers (150,000 volts has been attained), but, as indicated, there is an economic limit.

The current capacity of a selenium rectifier assembly is determined by the total area of its plates, the plate temperature (which should not exceed 75°-80° C.), and the permissible power loss in the rectifier itself, i.e., desired efficiency. A comparatively compact assembly will deliver considerably more current



TUBE RECTIFIER

Shaded portion in center indicates area filled with mercury vapor, argon, or xenon.

than tube rectifiers, although at low voltages. Any number of plates may be connected in parallel so that it is perfectly practicable to build single rectifier units with a continuous current capacity of 5,000 amperes (6 volts). The selenium rectifier is particularly suited to the production of high currents at low voltages.

Furthermore, unlike tube rectifiers, there is no difficulty in parallel operation, so that two or more complete selenium rectifier units may be connected in parallel to obtain still greater current output; or the same units may be operated in series for higher voltages. Electrical flexibility is one of the chief features of the selenium rectifier.

Selenium Unit Characteristics

The selenium rectifier is constructed of metal, and its operation is unaffected by position, vibration, or shock. In some industrial applications, this is important, although war requirements resulted in the development of remarkably rugged tube rectifiers.

The selenium rectifier has a voltage drop of about 1 volt at full load, as compared to 8-13 volts for gas-tube rectifiers. Furthermore, the internal drop decreases with decreasing load, and there is no filament power required. A typical large three-phase selenium rectifier equipment, even at high current density (for compactness and lower first cost), has a full-load overall efficiency of 65-75%, which is considered very satisfactory for low-voltage work.

Furthermore, the efficiency increases with decreasing load current, so that no power cost penalty is incurred if the equipment is operated at small loads.

The selenium rectifier undergoes no physical or chemical change with use, and so far as has been observed in the last fifteen years, there is no limit to the life of a selenium rectifier operated within its ratings. Electrical change, represented by a slight decrease in output voltage, occurs during the first 5,000-10,000 hours of use, but the rectifier then stabilizes and no further change occurs. (All good rectifiers are rated in terms of the final, *stabilized* output voltage.)

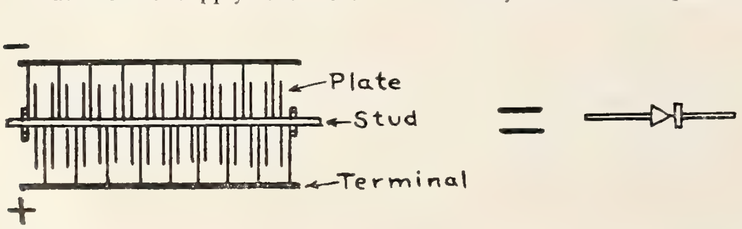
A selenium rectifier may fail if it is overheated, consequently larger units incorporate built-in cooling fans and should be so installed that there is an adequate supply of unheated air. There is no time lag in the operation of a selenium rectifier: It delivers DC instantaneously, as soon as the AC supply is closed. It is permissible to start a selenium rectifier unit with full load connected.

For low-voltage, high-current applications the selenium rectifier is the optimum choice, just as a tube rectifier is the correct choice for high-voltage, low-current applications. Between these extremes, there is a borderline area where either selenium rectifiers or tube rectifiers may be used. In such cases the design for both types is worked out, and final recommendations are based on a comparison of the performance and cost of each type.

The major factors which determine the choice between the selenium rectifier and the tube rectifier may be summarized as follows:

Ratio of DC voltage to DC amperage. Ruggedness requirements. Maintenance and replacement. Auxiliary equipment required (filament transformers, cooling fans, etc.). Cost and size. Local temperature. Efficiency. Speed of operation.

All of these factors, and many others, warrant careful consideration in any analysis of rectifier performance.



Representation of selenium rectifier structure and action.

50-mm Film Tests Seen as Industry Effort to Neutralize Competitive Threat

EXTENSIVE research in production and exhibition of 50-mm film, which may lead to changes as radical as those brought about by the introduction of sound films and color, is being carried on jointly by 20th-Fox, Western Electric and Eastman Kodak Co., it is reliably reported. Experimentation by the three firms, which includes the development of wide-gauge film, cameras and projectors, and the production of two test shorts, has cost an estimated $500,000 so far.

The 50-mm product was seen by some industry authorities as containing the answer to the threats of 16-mm home movies and television, as its use may permit many innovations in production techniques which would add considerably to the scope of the motion picture in the theatre.

Wider Sound, Visual Scope

The first 50-mm test short was completed last Fall, and it was described as "encouraging" by those who saw it, although they admitted that it was primarily a test of equipment and film rather than of production methods. A second short, "The Clod," has been completed by 20th-Fox and is in the laboratories.

Chief advantages seen so far in the 50-mm film was "audio sound," through which sound would be projected from its logical source on the screen, and the wider range of the lens, which would permit use of larger sets and more diverse action. The special cameras and projectors taking the 50-mm film were described as being virtually the same as the standard 35-mm equipment, on a larger scale. Lenses, sprockets and all other points where the wide-gauge film passes must be modified.

At present, three sound tracks instead of the usual one, are shot and projected separately to three loudspeakers behind the screen. Action to the left of the screen gets its accompanying sound from that direction. The other two speakers are to the right and center and reproduce speech or sound originating from their areas. Research was understood to be under way to combine the three sound tracks while still utilizing the multiple speaker setup.

The 50-mm film has approximately twice the area of 35-mm film and the image therefore offers much greater difficulty in handling. A theatre showing the wide-gauge product would have to install projectors equipped to handle it, a venture as costly as that which confronted exhibitors when they were forced to change to sound.

Limits 8- and 16-mm Field

It was pointed out that standard 35-mm prints from the 50-mm negatives might be feasible for those exhibitors who do not wish to convert. Thus, the larger theatres might economically make the changeover, while the smaller operators still would find 35-mm product available. The 50-mm picture could not be reduced to 16- or 8-mm, it was said, thus blocking out the home market for such films entirely. Neither was 50-mm production considered to be practical for television.

The increased scope of 50-mm film it was suggested, may provide the motion picture theatre with productions that cannot be duplicated in any other environment, and may do much to eliminate the competition arising from widespread private ownership of home projectors, "jack-rabbit" operators using 16-mm equipment, and television.

Recording Award to RCA

RCA recording equipment received recognition through a special Academy award designating "The Bells of St. Mary's" as the picture presenting the best sound recording in 1945. Also, the Academy presented a special scroll to Republic Pictures anent the achievement represented by the new Republic scoring auditorium, the acoustical consultant for which was M. J. Rettinger of the RCA engineering staff.

A New Super H. I. Positive Carbon†

By *M. T. JONES, R. J. ZAVESKY,* and *W. W. LOZIER*

MEMBERS OF THE ENGINEERING STAFF, NATIONAL CARBON COMPANY

Tests of a new 13.6-mm high-intensity positive carbon pulling 265-290 amps indicate an increase of screen light of 35 to 45 per cent for the transparency process projection, and a 40 to 60 per cent increase for theatre projection. Crater brightness, operating characteristics, requisite projection system components, including water-cooled jaws, and methods employed in testing this new carbon are detailed in the accompanying article.

TECHNOLOGICAL developments of the past 10 years have resulted in a succession of advances which have increased several fold the quantity of light which can be projected on a motion picture screen. This is true both for transparency process projection in the motion picture studios, and also for projection in motion picture theaters. These advances have resulted from improvements of the various components of the projector system including the carbon arc light sources, arc lamps, optical systems, projectors, *etc.*

Present theater projection systems make it possible to project 2 to 3 times as much light to the screen as was possible 10 years ago. Light levels with modern studio transparency process projection equipment can be as much as tenfold those of a few years ago. However, the industry has used all the light that is available and has expressed a desire for more.

Demonstrably, still further increases in screen light can be obtained with a new 13.6-mm experimental positive carbon which operates with a higher crater brightness than any carbon commercially available at the present time. This new 13.6-mm super h.-i. positive carbon is a result of intensive research and development work performed during the past few years and directed toward the goal of higher brightness.

Operating Characteristics

This article is concerned with the type of h.-i. arc and carbons wherein the positive carbon is rotated during burning and the negative carbon is placed at an angle with respect to the positive.

At the present time standard National 13.6-mm super h.-i. projector positives and National 16-mm super h.-i. studio positive carbons are employed to provide the highest levels of screen illumination for background projection, and the 13.6-mm carbons to give the maximum screen light for theater projection. These 13.6-mm and 16-mm carbons operate at 170 amps and 225 amps, respectively. In comparison, the new 13.6-mm super carbons have been burned at currents up to approximately 290 amps.

Research has shown that the brightness of the h.-i. carbon arc depends, among other things, upon the density of current entering the crater. Increased current density signifies greater concentration of electrons, positive ions and excited atoms in the crater gases which are the principal source of light. Following this principle, carbon compositions and methods of burning have been developed which allow a much greater dissipation of energy per unit area within the crater and results in increased brightness.

Water-Cooling Employed

The new 13.6-mm positive carbon has been designed in this fashion. It has been operated at currents up to approximately 265 amps in lamps with conventional air-cooled positive jaws.

However, the composition of the new carbon is such that its maximum current rating can be extended to currents higher than 265 amps by employing methods which will more effectively cool the positive carbon. One means of accomplishing this result has been the use of water-cooled jaws of a special design in combination with a short protrusion of the end of the positive carbon beyond the jaws.

The important features of this design are illustrated in Fig. 1. The cooling water in the jackets, *J*, comes into direct contact with the silver blocks, *S*, which fit snugly around the positive carbon, *P*. Fig. 2 shows in more detail the design and construction of the silver contact blocks. This design, coupled with the high conductivity of silver, permits unusually rapid removal of heat from the carbon. Flow rates of water of approximately one gallon per min. are more than ample to take care of any of the operations described herein.

A new $\frac{5}{8}$-in. copper-coated negative has been developed to operate with the new 13.6-mm carbon. This negative carbon can be used in the conventional manner. Another type of negative also has been developed for use with the new positive carbon. This is an unplated 7-mm negative carbon which is designed to operate in special water-cooled jaws. This type of negative carbon has ample current-carrying capacity for operation over the 265-290-amps range.

The absence of a copper plate eliminates any possibility of copper drippings adhering to the lamp optical system. The cooling water dissipates heat which otherwise would be absorbed by lamp parts. Improved arc stability is obtained through use of the smaller diameter negative carbon.

Studies have been made in a laboratory test lamp on the burning performance of the new 13.6-mm super carbons in comparison with the standard 170-amps, 13.6-mm and 225-amps, 16-mm super carbons. Crater brightness and

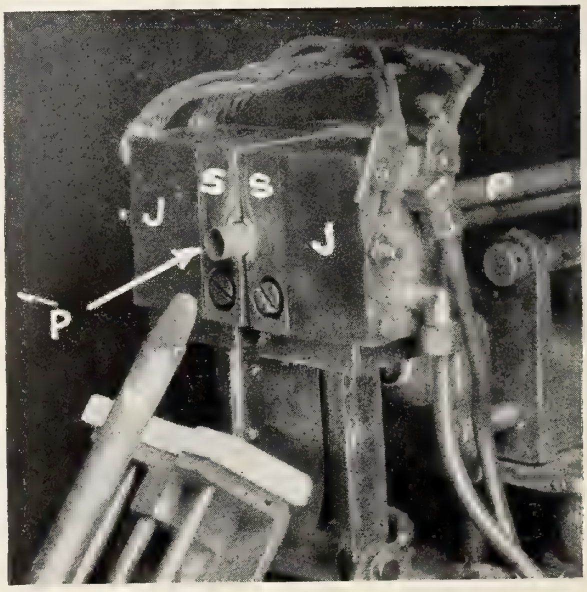


FIGURE 1.
Special water-cooled jaws for positive carbon showing S, silver contact blocks; J, water jacket; P, positive carbon; and N, negative carbon.

† J. Soc. Mot. Pict. Eng., December, 1945.

total crater candlepower were measured. The 3 types of carbons were operated both with air-cooled and with the special water-cooled positive carbon jaws. The results appear in Table 1 and in Fig. 3.

Brightness Distribution

Figure 3 shows the brightness distribution across the crater for the 13.6-mm carbons. The new 13.6-mm carbon at 265 to 290 amps has a brightness at the center of the crater ranging approximately from 1200 to 1400 candles per sq. mm. These values, respectively, are about 30 to 50 per cent greater than the brightness of the 170-amps, 13.6-mm carbon.

A maximum operating current of 265 amps was obtained for the new 13.6-mm carbons with a $1\frac{3}{8}$-in. protrusion both with air-cooled jaws and with special water-cooled jaws described previously; the burning characteristics were practically identical with both types of jaws. However, a reduction in protrusion to $\frac{1}{2}$-in. with the special water-cooled jaws allowed the maximum operating current to be increased to 290 amps.

Some insight into the significance of the combination of water-cooled jaws and short protrusion may be obtained from measurements of the amount of heat carried away by the cooling water. With a positive carbon protrusion of $\frac{1}{2}$ in. and a current of 290 amps, the amount of power carried away as heat by the cooling water was 4.2 kw, which is approximately 18 per cent of the input power to the arc.

When the protrusion was increased to $1\frac{3}{8}$ in. with a current of 265 amps, the power carried away as heat decreased to 2.8 kw, which is 13 per cent of the arc power. This difference in heat transfer by the cooling water made it possible to burn the new carbon at the higher current.

The data in Table 1 show that the burning rate of the new 13.6-mm carbon is 45 in. per hour, or approximately double that of the standard 13.6- and 16-mm carbons. Significantly, there was no increase in burning rate of the new 13.6-mm carbon with the increase in current from 265 to 290 amps. The explanation for this observation undoubtedly rests on the improved cooling and reduced oxidation afforded by the decrease in protrusion which accompanied the change in current.

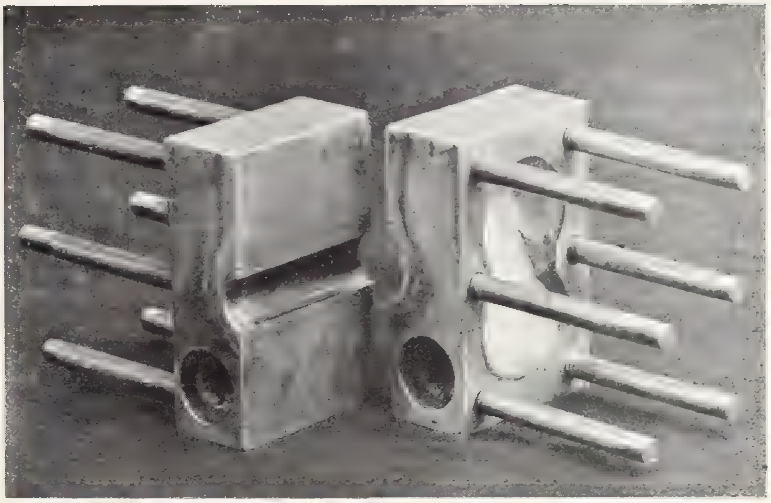


FIGURE 2. *Close-up of silver contact blocks and mounting studs.*

Background Projection Use

There is general recognition of the important role of transparency process projection in modern motion picture production. Although improvements in recent years have greatly expanded the usable area of process projection screens, the present possibilities are often less than desired.

It was visualized that the new 13.6-mm super carbons might offer a significant improvement in quantity of screen light available for background projection. Consequently, arrangements were made to obtain information on this point.

Through the cooperation of Farciot Edouart of Paramount Studios, Hollywood, we were able to test the new 13.6-mm carbons in the transparency process projection equipment.

This equipment contains the Paramount design of relay condenser system which has shown such merit in process projection. This equipment also employs the Mole-Richardson arc lamp designed to Academy Research Council Process Projection Specifications. This lamp utilizes water-cooled positive carbon jaws and head, and the positive carbon protrusion from the jaw was $1\frac{5}{8}$ in.

Under these conditions it was found that the new 13.6-mm super positive carbon and $\frac{5}{8}$-in. negative carbon could be burned at currents as great as 265 amps. As bases of comparison, tests were also made with the commonly used 16-mm super high-intensity studio positive at 225 amps, and with the 13.6-mm super high-intensity projector at 170 amps. The steadiness of the light was practically equivalent on all carbons at the indicated currents.

The results of the measurements given in Table 2 show that the new carbon offers approximately a 30 per cent increase in screen light over the 16-mm standard carbon at 225 amps; and a 45 per cent gain over the 13.6-mm 170-amps carbon. Distribution of intensity on the screen was good and was

TABLE 1. *Comparative Operating Characteristics of Various H.I. Carbon Combinations.*

Positive Carbon	Negative Carbon	Positive Carbon Jaws	Protrusion of Positive Carbon	Amp	Volts	Burning Rate of Positive Carbon—In. Per Hr	Crater Cp
Standard 13.6-mm Super High-Intensity Projector	"Orotip" $\frac{1}{2}$-in. Heavy Duty	Air-cooled or Special Water-cooled	$1\frac{3}{8}$ in.	170	75	22	78,000
Standard 16-mm Super High-Intensity Studio	"Orotip" $\frac{17}{32}$-in. Heavy Duty	Air-cooled or Special Water-cooled	$1\frac{3}{8}$ in.	225	75	22	95,000
New 13.6-mm Super High-Intensity	New $\frac{5}{8}$-in. Copper Coated	Air-cooled or Special Water-cooled	$1\frac{3}{8}$ in.	265	80	45	106,000
New 13.6-mm Super High-Intensity	New $\frac{5}{8}$-in. Copper Coated	Special Water-cooled	$\frac{1}{2}$ in.	290	80	45	116,000

Note.—Lamp operated with negative at an angle of 53 degrees below the positive and with a $\frac{7}{8}$-in. arc length between the tip of the negative and the center of the positive crater face.

quite comparable with all the combinations employed.

This new carbon, which offers increases in illumination of from 30 to 45 per cent over that obtainable from present standard carbons, should make available a significant increase in usable screen area. It is estimated that an additional 10 to 15 per cent increase in screen light would be expected from operation at 290 amps, which can be made possible as described previously.

The new 13.6-mm positive carbon was also considered with respect to the quantity of screen light available for 35-mm film projection with a standard condenser optical system such as used in theaters. The 13.6-mm super h.-i. projector carbon and the new 13.6-mm carbon were compared in laboratory tests using a standard 35-mm film aperture and $f/2.2$ condensers (operated at $f/2.0$ distances) and with a treated 5-in. focal length $f/2.0$ projection lens.

TABLE 2. ***Screen Light for Transparency Process Projection***

Positive Carbon	Amp	Relative Screen Lumens*
Standard 13.6-mm Super High-Intensity Projector	170	90
Standard 16-mm Super High-Intensity Studio	225	100
New 13.6-mm Super High-Intensity	265	130

* Measured at Paramount Studios with relay condenser system and silent camera aperture (0.723 in. × 0.980 in.).

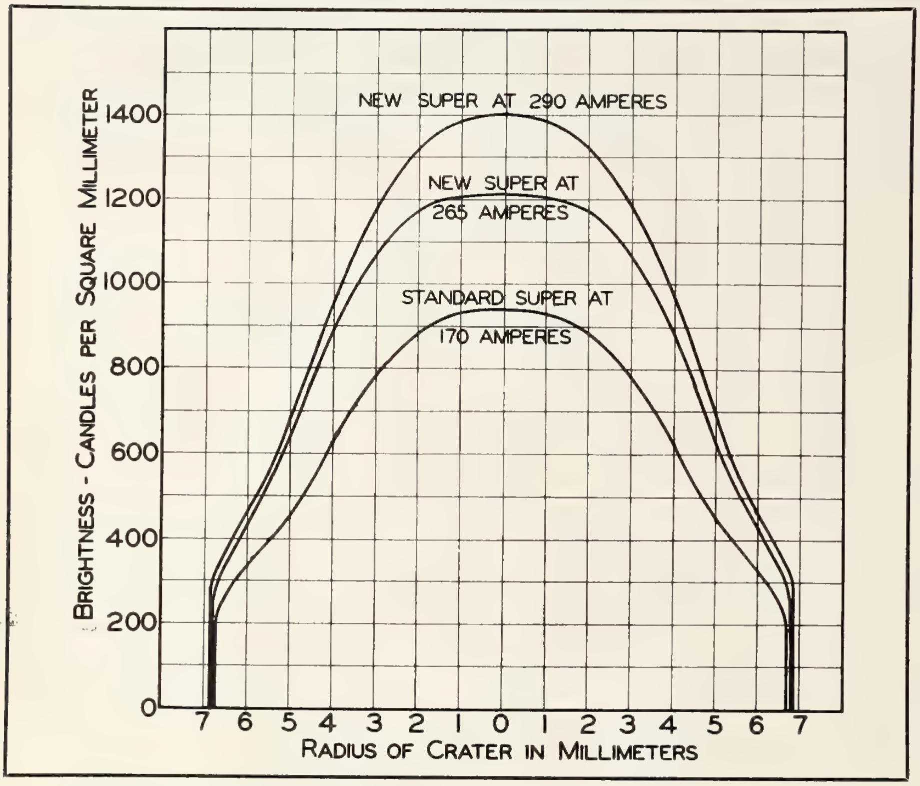


FIGURE 3. ***Distribution of brightness across crater of 13.6-mm super carbons.***

As shown in Table 3, the measured screen light without shutter or film was increased from 18,500 lumens for the 13.6-mm, 170-amps carbons to 26,000 lumens with the new 13.6-mm positives operated at 265 amps and to 30,000 lumens at 290 amps. *This should make available 40 to 60 per cent more screen light than the maximum now obtainable.*

Determinations of the intensity of radiant energy incident at the center of the film aperture were made with the 13.6-mm super and the new 13.6-mm carbons in the aforementioned condenser optical system. The technique used involves the use of a pinhole aperture, thermopile, and filters.

The intensity of radiant energy is listed in Table 3 in combination with the screen light data obtained. With the new 13.6-mm positive the maximum intensity at the center of the film aperture is 1.45 to 1.65 w per sq. mm compared with a value of 1.05 w per sq. mm for the standard 13.6-mm super h.-i. projector positive carbon system.

By using a heat filter it is possible to reduce markedly the total energy flux at the film aperture with a smaller reduction in light intensity. There are filters which reduce the total radiant energy approximately 50 per cent with a light reduction of perhaps 20 per cent. With such a filter, the total radiant energy incident at the center of the film aperture can be reduced to nearly the same level as for 125-amps, standard 13.6-mm condenser systems with approximately twice as much light.

With a heat filter of 80 per cent light transmission, a 90-degree film shutter and 75 per cent screen reflectivity the 290-amps operation should yield a brightness of 12-ft-L, the approximate average of the ASA Standard range, at the center of a screen 35 ft. in width, which is 25 per cent wider than can be illuminated to this intensity with the 170-amps, 13.6-mm carbon.

It must be recognized that adequate provisions must be made so that all the components of the projection system will accommodate the special features of the new carbons. For example, the lamp must be adapted to the faster burning rate of the new carbons. The lamp parts, the condenser lenses, and the projector parts near the aperture must be able to withstand the increased heat from the arc. Heat filters or other provisions will be necessary to prevent undesirable effects caused by heat on the film.

When these factors are properly taken into account, these new carbons will offer noteworthy increases in light.

TABLE 3. ***Screen Light for Motion Picture Projection***

Positive Carbon	Positive Carbon Jaws	Protrusion of Positive Carbon	Amp	Screen Lumens*	Radiant Energy at Center of Film Aperture—Watts Per Sq Mm**
Standard 13.6-mm Super High-Intensity Projector	Air-cooled or Special Water-cooled	$1^3/_8$ in.	170	18,500	1.05
New 13.6-mm Super High-Intensity	Air-cooled or Special Water-cooled	$1^3/_8$ in.	265	26,000	1.45
New 13.6-mm Super High-Intensity	Special Water-cooled	$^1/_2$ in.	290	30,000	1.65

* At 80 per cent side to center distribution without shutter, film or filters, and with standard 35-mm (0.600 in. × 0.825 in.) aperture; $f/2.2$ condensers and $f/2.0$ treated projection lens.

** Radiant energy measurement made with system adjusted to give maximum intensity at center of film aperture.

Both of these scenes were made in daytime —the larger on Eastman Infrared Film.

REALISTIC NIGHT SCENES—in sunlight with a suitable filter—as well as other spectacular effects are "routine" for Eastman Infrared Negative Film, one of the family of Eastman Films, favorites of the industry for more than fifty years.

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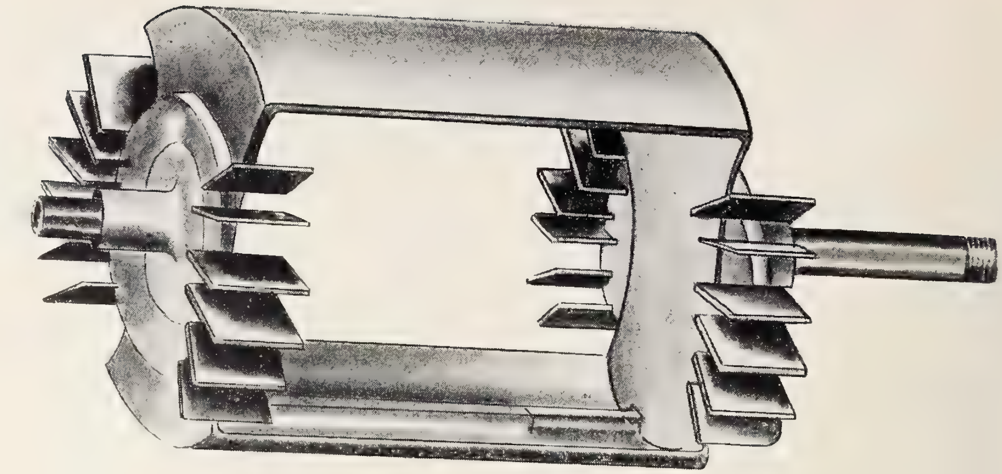
EASTMAN INFRARED NEGATIVE ... for dramatic effects



Drawing showing the two blades of the Motiograph cylindrical shutters.

The Barrel-Type, Cylindrical Shutter

By *LEO DANIELS*

PROJECTION ENGINEER, MOTIOGRAPH

Variations of the basic means for motion picture projection light cut-off are described herein, with especial emphasis on the development of the barrel-type, cylindrical shutter. The author has been associated with Motiograph as a projection engineer for the past 35 years.

THE primary function of the shutter of a projector mechanism is to impart to the pictures on the screen a better illusion of motion. The shutter has been a recognized part of the projector from the very beginning, although since 1896, when the first commercially practical motion picture projectors appeared, there have been a number of changes in shutter size, form and location.

The Optigraph of that year (predecessor of today's Motiograph) employed one of the first types of shutters. This shutter was located between the aperture and the lens, while each of the two blades was cup-shaped. This principle was retained in the Optigraph and in the Model 1-A Motiograph for some years.

Other projector mechanisms of the early days (including some of the first Motiograph models) had a disc-type shutter located on the front of the mechanism, and consequently in front of the projector lens. In fact, this principle of a front shutter was retained on all projector mechanisms until 1930, when Motiograph changed the location of the shutter from the front of the mechanism to a point between the aperture and the light source. At the same time Motiograph introduced the double shutter. Other projector manufacturers subsequently changed the position of their shutters in similar fashion, although they still retained the single shutter.

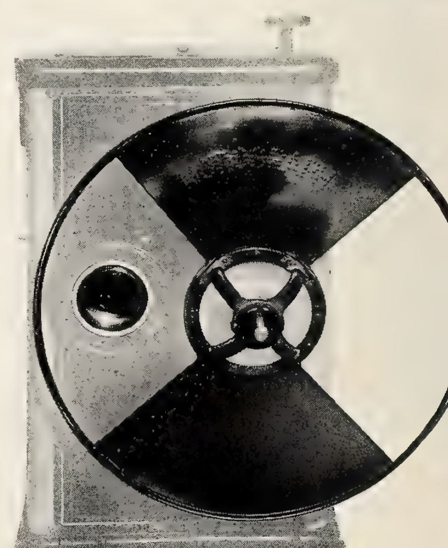
The shutter on the Motiograph 1A Projector (1908), located between aperture and lens, showing how the blades cover the aperture.

The Double Shutter

This change of shutter location was actuated primarily because of the inability of the front shutter to prevent the heat of the light source from pouring on the aperture and the film. Where a front shutter was employed, the heat from the lamp caused buckled film and even brought about a warping of the metal in the projector mechanism itself. This problem was accentuated by the introduction of more powerful arc lamps which gave out more light and consequently greater amounts of heat.

The change of the single disc-type shutter from front to back, therefore, represented a development of the utmost importance, inasmuch as it partially accomplished the function of dissipating the heat from the aperture and the film. At this point, the writer cannot help but decry the continued use of mechanisms of the front-shutter type in thousands of theatres. They are not only the cause of theatre fires and the ruination of many prints, but the quality of the projected image is seriously impaired.

While the placement of the shutter between the arc lamp and the aperture was one of the greatest single improvements in projection practice, the disc-type rear shutter was really nothing more or less than the old in-front-of-the-lens shutter, although somewhat enlarged in diameter in some cases. Other than partially solving the heat problem, it did not materially improve the light on the screen nor the picture definition. In an effort to improve the projected picture, the



Front shutter type used on Motiograph Model F (1921), with lens uncovered.

other major projector manufacturers eventually followed Motiograph's practice of using a double shutter.

One manufacturer conceived the idea of equipping a projector mechanism with both a front and rear shutter, each of the two-blade type and mounted on the same shutter shaft. Both the front and rear shutters rotate in the same direction, but they produce the optical effect of cutting the light beam from opposite directions. This is caused by the projection lens being located between the shutters—the lens reversing the beam so that its bottom rays on the lamphouse side are its top rays on the screen side.

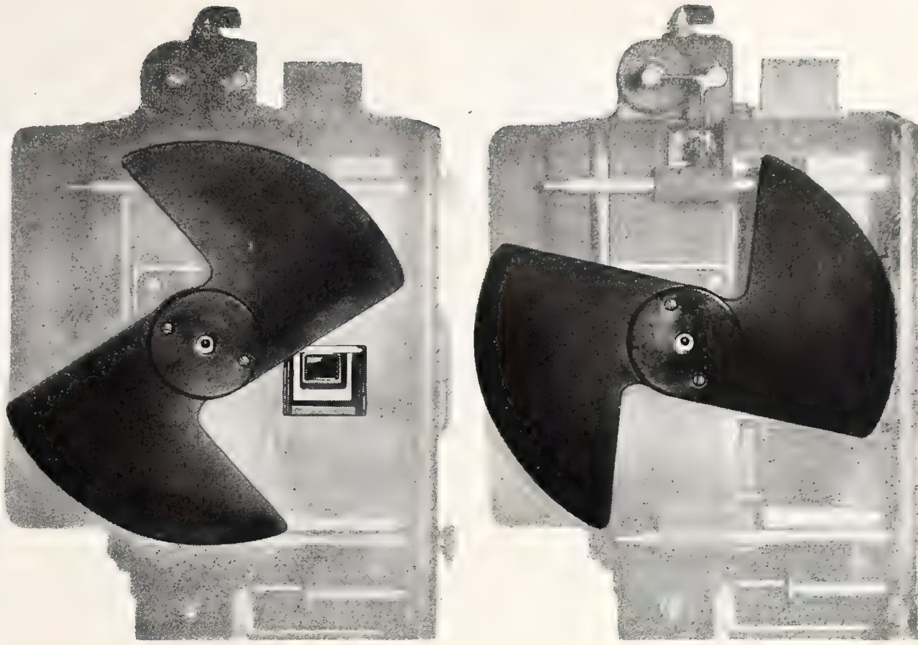
Two other manufacturers employ two double-blade disc-type shutters operating between the light source and the aperture. These shutters move in opposite directions, as they operate behind the aperture and the projection lens.

Motiograph, originator of the double shutter, continues the use of a double shutter operating between light source and aperture. These shutters, however, run horizontally or transversely to the light source; whereas in the three double shutter mechanisms referred to previously, the shutters operate in a vertical position.

One often hears the question from exhibitors, "Which is the best projector to buy—one with a single-disc shutter, or the double-shutter mechanism?"

Comparative Shutter Actions

It is true that projector mechanisms with the double shutter are higher in initial cost than those with a single shutter. It is likewise true that all of the better models of the leading makes of projectors are equipped with double shutters. This would indicate that the double-shutter mechanism is definitely better.



Single disc-type rear shutter, with aperture open and closed.

It is, and here is the reason therefor:

The single disc-type rear shutter has two blades of equal size, one of which (known as the master blade) cuts off the light from the screen during the period in which the intermittent movement is pulling the film into place at the aperture. The second blade (known as the balancing blade, or cut-off blade) is located at the opposite diameter from the master blade and covers the aperture for a short period of time while the film is at rest. The master blade of the shutter is the one which really gives the illusion of motion to the pictures on the screen; while the balancing blade reduces the flicker that would show on the screen if the shutter had nothing but the one master blade.

When two disc-type shutters are employed, operating between light source and aperture, there are, of course, two master blades and two balancing blades, with the two master blades cutting the light beam at the same time from opposite directions. Hence, as the time required to cut the light off the screen and restore it is reduced by one-half as compared with the single shutter, the screen receives a proportionately increased illumination. The same effect is produced by the mechanism employing a front-and-rear-type shutter, even though they revolve in the same direction.

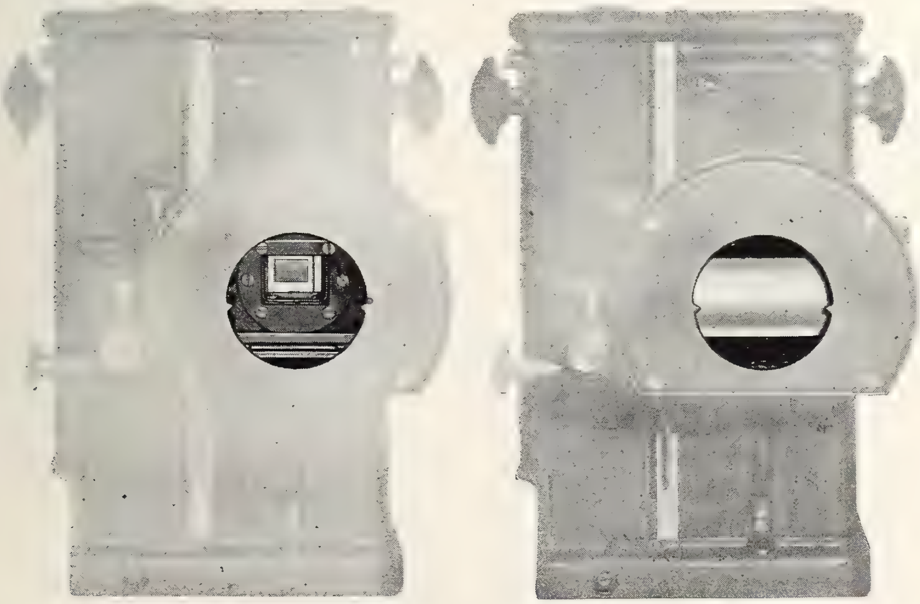
Reference to the illustration of the Motiograph horizontal cylindrical shutter will show that it has but two blades; while the double shutters of other makes have four blades, two of which are master blades and the other two balancing blades. At first glance, therefore, one not proficient in motion picture projection might gather the false impression that the horizontal cylindrical shutter is not a true double-shutter type. The Motiograph shutter is, of course, a true double shutter in every sense of the word, as is proved by the following detailed description.

Shutter Speed, Width

The Motiograph horizontal shutter is a light metal casting rotating on ball bearings and enclosed in a small metal housing. The shutter is positioned transversely (horizontally). In its cylindric surface are two openings through which the light beam passes; the rest of the cylinder serves exactly the same purpose as the blades of the disc shutter.

What is true of the speed and width of the disc-type master blade edges does

(*Continued on page 29*)



Cylindrical type double shutter (employed on Motiograph Model K), with aperture open and closed.

Ignorance or Indolence —or Both?

The terrific publicity splash in the daily and the trade press occasioned by the recent demonstration of the Western Union concentrated-arc lamp, particularly anent its application to the motion picture industry, served to reaffirm the smart press agent's faith in the magical space-pulling power of the word "movies," however remotely it be tied-in with the subject under consideration. Page-one smashes in the Sunday editions of such eminent New York newspapers as the *Times* and the *Herald-Tribune*, both of world-wide repute and having national coverage, is really going to town. As for the film trade press—well, its batting average on matters technical is too well known to need recounting here.

This is not to say that Western Union hasn't a nice piece of property in its zirconium lamp. It has, indeed—for certain, well-defined applications. But to even suggest (*as W. U. does not*) that this lamp will "revolutionize" present lighting practices, in both production and exhibition, in the motion picture industry is ridiculous on the face of even a cursory appraisal of the facts. These facts are presented elsewhere on this page.

Of a piece with such fantasies as three-dimensional motion pictures "tomorrow," continuous projectors, metal film stock, glass screens, "natural" color and "inexpensive" acetate (and paper) stock, this W. U. lamp story reveals anew the abysmal ignorance of technical matters on the part of the film trade press, no less than its penchant for indiscriminate rewrites of newspaper stories and bland acceptance of publicity handouts.

This zirconium lamp story certainly had the industry in a dither, for which state of mind an irresponsble trade press is at fault. No portion of blame for this situation attaches to W. U.; in fact, W. U. disavows the aforementioned baseless claims advanced for its product. One needed only to view the zirconium lamp in operation, consider the data graciously made available by W. U., and draw conclusions on a basis of comparison with equipment currently used in the motion picture field. This I. P. did.—THE EDITOR.

The W. U. Concentrated-Arc Lamp

EVALUATION of the Western Union concentrated-arc (zirconium) lamp, the topic recently of vivid and extensive press reports, as an adjunct of the motion picture projection process requires consideration on a comparative basis of how much light of what quality for how much money. This time-honored and tested basis is the only procedure that has any real meaning.

This W. U. lamp (see illustration) is basically a direct-current arc made with permanent, fixed electrodes which are sealed into a glass bulb filled with an inert, or "noble," gas (argon, helium, etc.). The lamp in size and appearance greatly resembles a home radio tube.

The source of light is an incandescent spot which forms on the specially prepared negative electrode (cathode). This cathode is made by packing zirconium oxide into a small cup or the open end of a tube made of either tungsten, molybdenum or tantalum, all of which metals have high-melting points. The positive electrode (anode), also of metal, consists of a simple sheet or plate of sufficient radiating surface so that during operation it will reach no more than a dull red glow.

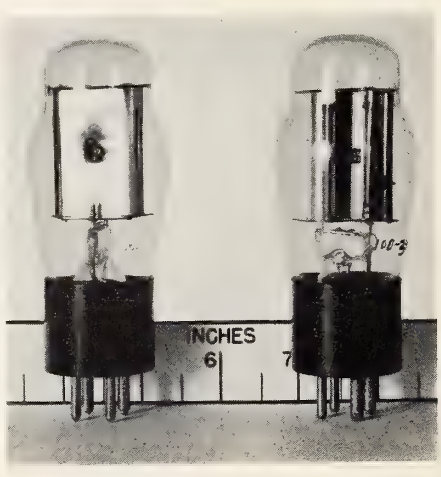
These two electrodes are so mounted in the bulb that the exposed surface of the cathode is but a few hundredths of an inch from, and directly behind, a hole in the center of the anode which provides a window for the emergence of light from the cathode.

In the manufacturing process, the bulb is first evacuated and then filled with an inert gas to almost atmospheric pressure. The cathode is then formed by means of a high-potential D. C. connected to the electrodes which produces an arc between the anode and the metallic tube of the cathode. Within a few seconds the cathode becomes red hot and heats the zirconium oxide packed into it to a temperature where the oxide becomes electrically conductive. The arc then strikes between the anode and the oxide, raising the latter's surface temperature to above its melting point. The molten oxide flows and bonds itself to the sides of the metal tube, following which the zirconium atoms form a thin surface in equilibrium with the molten oxide.

Molten Oxide Light Source

It is this film of molten oxide which is the chief source of the lamp's light, and, once formed during manufacture, this film remains ready to be heated to incandescence whenever the lamp is relighted or "struck." So thin is this film that surface tension holds it to the oxide backing, thus the lamps may be burned in any position.

These W. U. lamps are available in four sizes: 2-, 10-, 25-, and 100-watt ratings. They operate on D. C. obtained by means of special power packs which, in the case of the 100-watt lamp (the only size considered herein) costs $320. The lamp itself costs $42.75—although an extensive production schedule for both power pack and lamp undoubtedly would effect a sharp reduction in price. Lamp life is rated at 1000 hours.



Front and rear views of W.U. 100-watt zirconium lamp (2/3 actual size).

The lamp is started, or "struck," with an exceptionally high voltage which breaks down the arc gap, of the order of 2000 volts for the 100-watt lamp. It may be run from a power source supplying from 24 volts up, higher voltages resulting in more stable operation. The lamp must be operated from a well-filtered rectifier or a generator or battery with sufficient ballast resistance in series to limit the current to its normal value. This resistance must always be included, since the lamp has a negative volt-ampere characteristic and would otherwise draw currents which might destroy it.

Restricted Distribution Angle

This W. U. lamp is what is commonly known as a narrow-beam or straight-line light source, its luminous spot, only .059 inch in diameter, being necessarily restricted by the lamp structure which utilizes a metal shield to encompass the light-emitting area. Curves supplied by W. U. show that these lamps have a cosine distribution, which means coverage of an area of but 90° at most, as contrasted with the 140° standard pickup angle of mirror-reflector arcs now used in projection.

This light-distribution angle is a most serious limiting factor in itself and practically eliminates the W. U. lamp from any serious consideration as a light source for film projection. But the lamp

(*Continued on page 27*)

IN THE SPOTLIGHT

By *HARRY SHERMAN*

A DECISION of far-reaching importance to every I. A. Local was handed down recently by the Common Pleas Court in Toledo, Ohio, in a case which undoubtedly will have repercussions in other sections where similar situations exist.

Toledo Local Union 228 was the defendant in a $25,000 action instituted by a member of a Local in another city who, having worked under Local 228's jurisdiction during the manpower shortage, demanded a permanent membership card in that organization. Local 228 based its defense upon the fact that its first obligation was to its own members who, upon their return from the armed forces, had prior rights to any and all jobs to the exclusion therefrom of any and all nonmembers.

The plaintiff charged that, having been displaced in his job by a member of Local 228, he was being denied his constitutional right of earning a livelihood as a projectionist, and that he should be granted a membership card in Local 228.

The judge's decision in favor of Local 228 said, in part: "A member of a union, by the very fact of membership, agrees to abide by the laws and constitution of that union. A union man must first exhaust all remedies as provided by the rules, by-laws and constitution of his local union and his international union before he can prevail in an action in court."

In our opinion, this decision was just and fair, it being the duty of every local union to observe its laws and constitution, since only in this way can it protect the rights of its members.

● California District Council No. 2, embracing all I. A. local unions in Southern California, exemplifies the spirit of cooperation sought by many union organizations but, unfortunately, is so seldom attained. This group meets every three months, the place of meeting being by invitation of different locals. During recent wage negotiations with the major circuits, all the local unions in this group worked together harmoniously, with the result that practically all their demands were granted: full 15% wage increase, two weeks' vacations with pay, and increased preparatory time with pay.

Alonzo S. Bennett, recently re-elected secretary-treasurer of the Council for the third consecutive term, is one of its most ardent supporters and writes in glowing terms of the fine work done by its officers and individual members.

● The basis for organized labor's unqualified and unremitting opposition to the notorious anti-union Case bill now pending before the House of Representatives was eloquently expressed by Secretary of Labor Schwellenbach in a recent appearance before a Senate committee. Said the Secretary:

"The records of Congressional investigating committees contain uncounted instances where employers have provoked labor disputes and taken prompt and full advantage of their existence to provoke disorder. . . . I cannot emphasize too strongly the inherent inequity of a provision which seems to assume that the blame for any disorder in a labor dispute rests solely on the employes."

This is blunt but honest opinion for our lawmakers to digest.

● For the first time in many years, New York Local No. 306 voted overwhelmingly to send its full quota of 24 delegates to the forthcoming I. A. Convention. Out of the 50 candidates nominated, the following, listed in order of number of votes received were elected: Herman Gelber, Morris Kravitz, Charles Beckman, Ben Scher, Nathaniel Doragoff, Steve D'Inzillo, James Ambrosio, Harry Garfman, Joe Basson, Tony Rugino, Frank J. Inciardi, Max Rosenberg, Mike Springer, Eddie Stewart, Harry Mackler, Dave Garden, Izzie Schwartz, Harry Storin, Charles Eichhorn, Dick Cancellare, Herman Boritz, Ernie Lang, William DeSena, and Charles Kielhurn.

These delegates probably will have a table all for themselves and, no doubt, will be very much in evidence at the proceedings.

● Jack Hauser, business agent of Worcester Local No. 96 for more years than we can remember, was recently voted a new automobile by the members of the local to replace the one wrecked in an accident several weeks ago. Although the car he was riding in was

OBSERVES 15TH ANNIVERSARY AT RADIO CITY MUSIC HALL

Charlie Muller (center) is "mugged" on his 15th anniversary as supervisor of projection for the world's largest film and presentation theatre. Charlie's cozy domain includes 1 theatre projection room, 4 spot rooms, 1 rheostat room, a small preview theatre, an office and a showerbath room for the boys. Flanked by 2 of his 14-men crew, Charlie poses against a background of 4 new Simplex E-7 projectors.

damaged beyond repair, Jack escaped with a fractured collar bone and a severe shaking up. His injuries, however, have not prevented him from attending to his regular duties, both as an officer of the local and as stage manager of Poli's Palace Theatre.

Hauser has been a member of the Worcester local for the past 31 years, most of which time he served in an official capacity. He has represented the local at 18 I. A. Conventions and at all conventions of the Massachusetts State Federation of Labor. He also represented Local 96 at the Third District (New England) conventions for many years, and is active in all movements sponsored by the Worcester Central Labor Union. All in all, it may be seen that Jack Hauser is kept pretty busy representing his local at various labor gatherings, in addition to his regular duties as business agent.

● The executive board of New York Local No. 306 appointed Nathaniel Doragoff, Mike Springer, and Edgar Stewart members of a committee to investigate and recommend plans for a Local educational program. At the last regular meeting this committee made the following recommendations which were adopted by the membership:

N. Doragoff

1. The Committee recommends that Local 306 commence an education program as provided for by Article 18 of the By-Laws of our Constitution.

2. That Local 306 secure television equipment and instructors to demonstrate that equipment to our membership and to give lectures as how to use that equipment and how to make the necessary minor repairs thereon.

3. That Local 306 also secure the latest devices on projection, whether 16- or 35-mm, and have lectures and demonstrations given thereon.

4. That all this equipment be acquired gratis, if possible; but if it can't be acquired gratis, that the proper appropriations be made therefor.

For the past several years free classes in television conducted under the auspices of the N. Y. City Board of Education have been attended by members of Local 306 and men then serving in our armed forces. Now that the war is over and the government's pressing need for men trained in the electronic arts has passed, Local 306 considers the presence of non-union students at these classes as unfair competition to organized labor, hence the adoption of the aforementioned recommendations.

● A ten-act vaudeville show for the benefit of the striking employees of the Yale & Towne Stamford plant was presented last month at the Palace Theatre in Stamford, Conn. Nicholas Trimboli, business agent for Stamford Local No. 449, who conceived the idea and was in complete charge of all arrangements, is receiving many tributes to his splendid management and fine showmanship. He was ably assisted by Anthony J. Marrucco, Joseph Bonomo, Jerry Saumo, and Larry De Mott, members of Local 449.

A committee headed by T. Ficaro and J. Burns, of the International Association of Machinists, in charge of ticket sales, reported a complete sellout for the performance. Irving Cooper, manager of the Palace Theatre, booked the acts and aided greatly in making this show one long to be remembered in Stamford theatrical history.

● Fred C. Stovenour, representative in Memphis for National Carbon Co., is the father of June Haver, noted screen star who appeared recently in "The Dolly Sisters." Proud-pappy Stovenour should get together with Eddie Miller, I. A. representative and business agent for Houston Local 279, who is the father of Nan Grey, movie and radio star.

● Wallace Crowley, George Schaffer, Charles Vencill, Magnus Nielsen, Earl Spicer and Ralph MacDonald will represent Los Angeles Local 150 at the forthcoming I. A. Convention in Chicago. We'll be seeing you.

● In reading the trade press we were very much impressed with the huge sums many exhibitors were planning to spend in remodelling their theatres. In one instance we read of a certain exhibitor who publicly announced he planned to spend $75,000 in modernizing his theatre. The irony of it is that this very exhibitor, during wage negotiations for a 15% increase for projectionists, bitterly fought the request, protesting he was on the verge of bankruptcy and that business losses would force him to close his theatre. The union officials, happily, were unimpressed by these pleas of poverty and refused to continue operations until the increase was granted.

The announcement mentioned earlier in this item followed the signing of the contract. What we can't figure out is how one can lose money in business and at the same time find $75,000 for improving one's property. Perhaps only theatre owners know the trick.

● We received a note from R. E. Waller, secretary of Denver Local No. 230 advising us of the death of George Thomas, an official of the Local for many years. Thomas was stricken with a heart attack, and his untimely passing was quite a shock to his many friends in labor circles. Our friendship with George dates back 25 years, during which time we attended many an I. A. convention together. He was secretary of the Fifth I. A. District for a number of years and enjoyed the friendship and esteem of all who knew him. We extend our deepest sympathy to his family.

● There is great joy these days in the household of Charles F. Wheeler, secretary-treasurer of Geneva Local No. 108, over the advent of a new son, Paul Douglas. Papa Wheeler outstruts a peacock these days and the cigar bill runs high.

● Long Beach, Calif., Local No. 521 recently ran a dinner-dance in honor of its members who served in World War II. With the exception of Lt. Elmer Holk, U. S. Navy, and Lt. Max G. Miller, U. S. Merchant Marine, who are still in service, all Local 521 enlisted men have returned to civilian status.

● We were visited several weeks ago by John Mongillo, president of New Haven Local No. 273. John is an amateur radio "ham" (W1IGT) and is anxious to contact other I. A. members who are also "hams." We suggested that he contact Z .A. Sax, secretary of Local No. 159, Portland, Ore., at W7FJZ.

Calgary, Local No. 302 Highlights

● D. B. MacKenzie, secretary of Calgary Local No. 302 and secretary-treasurer of I. A. District Number Twelve (Alberta, Saskatchewan and Manitoba), was re-elected president of the Provincial Federation of Labor by acclamation at the last convention. After having served as executive secretary for the Army and Navy Veterans for the last six years, MacKenzie declined the nomination this year due to his many other activities. In appreciation of services rendered, he was presented with a lifetime fountain pen. He is also a member of the Hospital Board in Calgary, representing labor.

D. A. MacKenzie

At a recent Local meeting, Alfred Brown, a charter member and former business agent, was presented with a gold life membership card. Brown recently retired from union activities due to ill health. He is a veteran of World War I, and is one of the very few remaining members of the famous Tenth Battalion.

Another member of the local, Harry Boyse, was elected secretary of the Trades and Labor Council in Lethbridge; and Art Wise, also a member

(*Continued on page* 26)

Basic Radio and Television Course

By *M. BERINSKY, E.E.*
MEMBER, INSTITUTE OF RADIO ENGINEERS

XXII—TRANSMITTER COMPONENTS

FIGURE 1 is a complete circuit diagram of a speech transmitter, the components of which are: speech amplifier, class A driver, class B modulator, crystal oscillator, buffer amplifier, class C rf amplifier, and power supply. The power supply, shown in simplified form in Fig. 2, contains a full-wave rectifier which works on both alternations of the 60-cycle input voltage.

When the plate of one #866 is positive, the plate of the other tube is negative. The positive plate attracts electrons which will flow in the direction shown by the arrows beginning and ending at the filament. Since two plates are used in this circuit, current will always flow in some part of the circuit, giving full-wave rectification. This type of rectification is practically always used because the output voltage is not highly distorted and is very easy to filter into a fairly pure form of D. C.

Note that separate transformers are used for the filaments and for the high voltage. This is common practice in transmitters and gives much latitude to the designer. The practice is almost never applied in receiver design because of cost and less severe design considerations.

It may be seen that separate switches are used for operating the high- and the low-voltage portions of the power supply. This procedure is necessary in transmitters and large P. A. systems. Tube life will be lengthened and serious damage to tubes prevented if the high voltage is not applied until the tubes have been heated to proper operating temperature. In amateur radio procedure it is also common practice to leave the tubes "on" during listening periods. The removal of the high voltage from the tubes' plates and screen grids will result in longer tube life.

The filter system is known as a choke input filter, that is, a choke is the first component used at the output of the recifier tube. A choke input filter gives a lower voltage but has better voltage regulation than a condenser input filter. This is a very important consideration in transmitter design. The regulation is a measure of the amount of voltage change at the output of the rectifier from no-load to full-load conditions, represented by the following formula:

$$\% \text{ Regulation} = \frac{\text{No-load voltage} - \text{Rated-load voltage}}{\text{Rated-load voltage}} \times 100$$

This value should be small in a properly designed power supply.

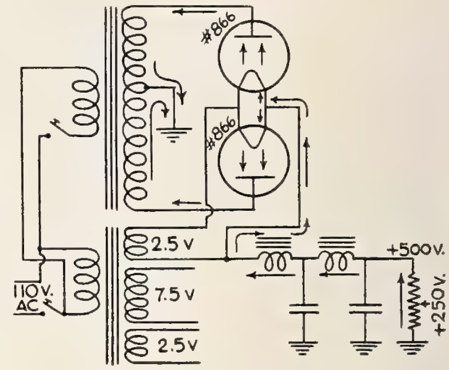


FIGURE 2. ***Typical transmitter power supply.***

The additional choke and condensers form the filter circuit the function of which is to smooth the pulsating D. C. which appears at the output of the tube. The filter action is due to the high time-constant of the condensers. These condensers, with values varying from 4 to 40 mfd., cannot charge and discharge as fast as the variations of pulsating voltage across them, but they can charge to the peaks of these pulsations. The average voltage developed across these condensers will look almost like a straight line—the desired result. The choke aids in the filtering action, since it tends to maintain a steady current.

The resistor across the second condenser is known as a "bleeder" resistor. By putting taps on this resistor it is possible to obtain any voltage from the maximum value to much lower values. These voltages are all positive with respect to ground. Negative values of voltage are also obtainable if a point up

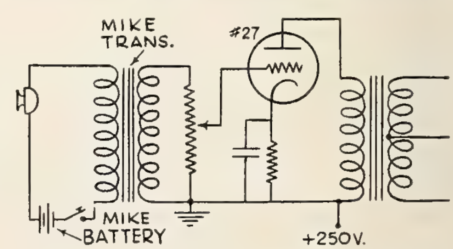


FIGURE 3. ***Class A speech amplifier with carbon microphone input.***

from the lower end of the resistor is grounded and the bottom of the resistor is connected to the high-voltage center tap on the transformer. The bleeder aids voltage regulation, and also tends to discharge condensers containing high

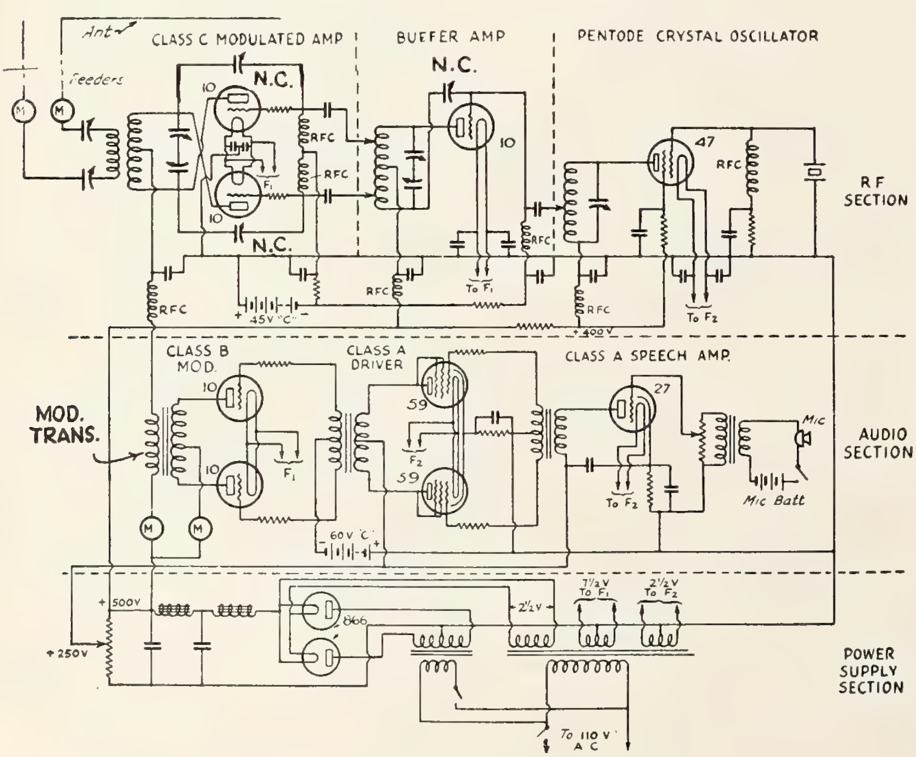


FIGURE 1. ***Complete phone transmitter.***

voltage after the equipment is shut off.

The speech amplifier, shown in Fig. 3, functions as follows: The "carbon microphone" contains carbon granules contained in a little cylinder called a "button." A piston moves freely in this cylinder and is connected to a diaphragm. When sound waves strike this diaphragm they set up a pressure which causes it to move. When the diaphragm moves, the piston, mechanically connected to it, will also move. The movement of the piston causes varying degrees of compression which change the electrical resistance of the carbon granules.

A battery is connected in series with the microphone and the primary winding of the microphone transformer. When the resistance of the granules changes in accordance with the sound waves striking the diaphragm, a pulsating D. C. is set up in the primary winding. This current will vary in accordance with the sound waves, thus we see that the sound waves, which are mechanical in nature, are changed into electrical impulses by the microphone.

Class A Speech Amplifier

The voltage on the secondary of the microphone transformer will be A. C. because the D. C. component cannot pass through the transformer. A variable resistor, which acts as a voltage-divider type of volume control, is connected across the secondary of the transformer, and the signal voltage is placed on the grid of the tube by means of this control. The signal voltage on the grid will drive it more or less negative, thereby controlling the plate current. Plate current variations will be set up in the primary of the second transformer and an alternating voltage will appear across its secondary.

The amplifier tube is called a class A amplifier. In class A amplification the plate current flows for the entire input cycle. This type of operation gives the least distortion but is inefficient in other respects. Class A amplification is nearly always used in radio receivers.

The operating point of grid bias must be such that the grid is never driven positive, and the plate current is never driven to cut-off. The grid bias is provided by the cathode resistor which

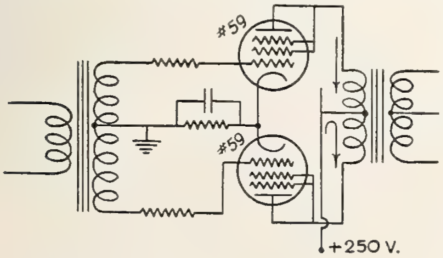


FIGURE 4. ***Class A push-pull driver stage.***

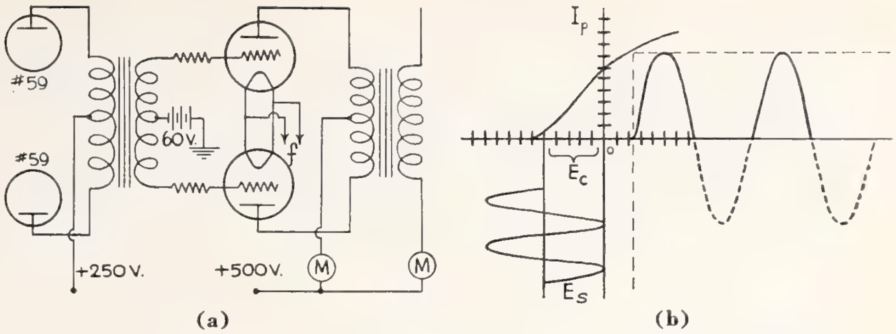


FIGURE 5. ***(a) Class B modulator stage; (b) class B tube operation.***

makes the grid negative with respect to the cathode. The condenser across this resistor filters out any A. C. components and makes the grid bias voltage nearly pure D. C.

The Class A Driver

The class A driver is used for supplying power to the grids of the #10 class B modulator tubes. The connections are shown in Fig. 4. Note that two tubes are used instead of the conventional circuit using only one tube. (Only single-tube amplifiers have been considered to date.)

Figure 4 shows what is known as push-pull circuit. Such a circuit is commonly used in expensive receivers, P. A. systems, and radio transmitters. The signal voltage appears on the primary of the first transformer. The secondary of this transformer is center-tapped and each outside end is connected to the grids of the #59 tubes.

Since the transformer is tapped at its exact electrical center, equal voltages will be placed on each grid. These voltages will be 180° out of phase due to the manner by which they are fed to the grids of the #59 tubes. This means that the signal voltage on one of the grids will be going positive as the other goes negative. The plate current in one tube will then increase as the current in the other tube decreases.

These currents flow through the primary of the second transformer in opposite directions. If these currents were D. C., complete cancellation of magnetic fields would occur in the primary and no signal would result. Actually, however, the currents are of opposite signs and are alternating. The effect of opposite current direction and opposite algebraic signs results in a positive action, as is indicated by the arrows in Fig. 4. Because of this action, twice as much power is developed in the transformer as is possible with only one tube.

Push-pull operation has the following advantages over single-tube operation: twice the power output; the D. C. hum component in the primary of the output transformer is cancelled out due to opposing magnetic fields being set up in this winding; second harmonic distortion is cancelled out in the transformer winding; and saturation of the core of the transformer by the component of plate current is prevented because the magnetic fields set up by these currents are cancelled in the output circuit.

Notice the method for supplying grid bias for the #59 tubes: the cathodes are tied together and a resistor which is common to both tubes is connected between cathode and ground. The current flowing through this resistor is the sum of the cathode currents in both tubes. A cathode by-pass condenser is placed across this resistor in order to filter the A. C. component of cathode current and provide a steady bias for the grids.

Class B Modulator

The Fig. 5a circuit is a class B modulator. This circuit supplies the power which appears in the sidebands contained in the modulated carrier wave. Class B operation is used as an economy measure.

In class B operation plate current flows for approximately half of the input cycle, as shown in Fig. 5b. The input signal (Es) is shown as containing two cycles, while the output plate current contains two half-cycles. The half-cycles shown in dotted lines will not be reproduced in the output, serving here simply as illustration.

It is obvious from Fig. 5b that the output plate current is not an exact

MARCH QUESTIONS AND CORRECT ANSWERS

1. ***(Q)*** **Why is the crystal preferred to other types of oscillators?**

   (A) It has much better frequency stability than most other types of oscillators.

2. ***(Q)*** **Give one disadvantage of a crystal oscillator.**

   (A) Its power output is small.

3. ***(Q)*** **Why is a cathode resistor used in Figure 7?**

   (A) To provide grid bias even when the circuit falls out of oscillation.

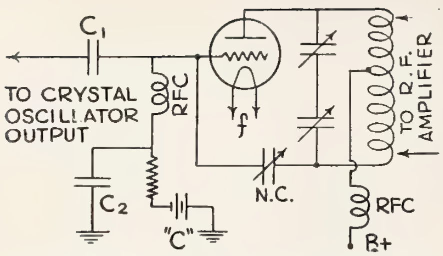


FIGURE 6. *Buffer amplifier stage.*

reproduction of input signal voltage, as is the case with the class A amplifier. If a single tube were used in class B operation, the output would be highly distorted because the output is not a reproduction of the input. When two tubes are used in class B operation, the resultant output will be a reproduction of the input signal. This is due to the fact that each tube would work on an alternate half-cycle of input signal, and the missing half-cycles shown by the dotted lines in Fig 5b would be supplied by one of the tubes. When the circuit is properly balanced, very little distortion in output will result.

Class B operation is more economical than Class A operation because of a smaller amount of tube heating. In class A operation plate current flows at all times, which means that a great deal of tube heating results. In class B operation plate current flows only on the positive half-cycle of input signal because the plate current is cut off on the negative half-cycle. This leads to less tube heating and more efficient operation.

Class B operation is not used in radio receivers to any extent because efficiency is not very important due to the fact that we are dealing with small amounts of power and operating costs are not given much consideration.

The crystal oscillator is not considered in detail here, having been covered adequately in the March issue. As we know, the purpose of the crystal oscillator is to generate the steady high-frequency carrier wave. Crystal oscillators are used widely at the present time because of their stability.

Buffer Amplifier Function

Figure 6 diagrams a buffer amplifier stage which serves several useful purposes. The output from a crystal oscillator is not very strong because strong oscillations would cause violent mechanical vibration of the fragile crystal. The buffer amplifier boosts the carrier strength without damaging the crystal.

An equally important function of the buffer amplifier is to provide sufficient isolation between the modulated stage and the oscillator so that changes in load represented by the variations in input resistance of the tube during modulation will not affect the frequency of the oscillator.

The signal from the oscillator is fed to the grid of the buffer amplifier through the coupling condenser C_1. The signal is prevented from entering the C battery by means of the RFC which offers a high impedance to a high frequency, and the by-pass condenser C_2 which offers a low-impedance path to ground for the signal. The amplifier boosts the signal in the usual manner and is fed to the RF amplifier from the tuned circuit in the plate of the buffer circuit. The RFC in the plate circuit keeps RF out of the power supply.

Neutralizing Condenser

The NC mark in Fig. 6 designates a neutralizing condenser. When a triode is used as an RF amplifier, the plate-to-grid capacitance of the tube will provide a path for the RF voltage in the plate circuit to feed back to the grid. This feedback voltage is in phase with the voltage on the grid of the tube and will reenforce it. The circuit will then act like a tuned-plate, tuned-grid type of oscillator. These oscillations are undesirable because it is the function of the circuit only to amplify.

The neutralizing condenser is connected to the lower end of the plate coil and back to the grid. The voltage fed back to the grid by this condenser will be 180° out of phase with the voltage fed back to the grid by the plate-to-grid capacitance of the tube.

RF Power Amplifier

When the capacitance of the neutralizing condenser is equal to the plate-to-grid capacitance of the tube, the two signals fed back to the grid will be equal in magnitude and opposite in phase, and will thus be cancelled out, eliminating any tendency for the amplifier to oscillate. The neutralizing condenser is made variable to allow for variations in tube and wiring capacities.

The RF amplifier handles large amounts of Power and is operated class C for most economical results. A class C amplifier is one whose power output is proportional to the square of the plate voltage. This makes it useful as an RF power amplifier with plate modulation.

The class C amplifier is operated with grid bias approximately twice that required to cut off the plate current with no signal. This circuit is shown in Fig. 1. Two tubes are necessary in order to prevent excessive distortion and to provide large amounts of power. Neutralization must be applied to both tubes, two neutralizing condensers being used for this purpose.

Modulation is applied in the plate circuit of this tube by the class B modulator tubes, through the modulation transformer. The modulated output from the RF amplifier is fed to the antenna, the signal thus being placed on the air. The adjustment of the stages in a transmitter are somewhat complicated and are beyond the scope of this article.

APRIL QUESTIONS

1. What is the purpose of the speech amplifier?

2. What is the purpose of the modulator?

3. What is the function of the neutralizing condenser in Figure 6?

The answers to these questions will appear in the next issue.

I. P. Subscription Rates To Advance May 1

Effective May 1 next, the subscription rates for INTERNATIONAL PROJECTIONIST will be as follows: For the United States and Possessions—1 year, $2.50; 2 years, $4. For Canada and other foreign countries: 1 year, $3; 2 years, $5.

This advance in rates has been made necessary by an increase of more than 36% in mechanical production costs alone during the last two-year period. Previous cost increases had been absorbed by I. P., the subscription price of which has been held constant for 15 years.

New and renewal subscriptions bearing a postmark not later than May 1 will be accepted at current rates.

RCA RECORDING LICENSE TO RKO-PATHE FOR TELE FILM

In a move of great significance to the motion picture industry RCA has granted to RKO-Pathe, Inc. (formerly Pathe News), a license to record and distribute sound motion pictures for use in television broadcasting.

It is not generally realized within the industry that the sound recording contracts held by film producers specifically prohibit the use of the end product of recording systems—that is, the finished motion picture—"in conjunction with a wireless frequency, carrier current, radio apparatus, or in television." The existence of this clause in sound recording contracts has long been known, of course, but it is only recently that its full import began to be generally realized throughout the industry.

As matters now stand, no Hollywood product can be utilized for television broadcasts, and this condition will endure until such time as the contracts are rewritten so as to permit such activity on the part of the film companies. Thus the significance of the RCA-RKO-Pathe deal.

DUO-SPEAKER WITH RESONANCE

At its Princeton, N. J., labs RCA has been showing the newest duo-speaker. This consists of a large heavy 12-in. cone for low frequencies, in the center of which is a small cone about 3 in. in diameter radiating the high frequencies. The frequency response of this newly designed speaker is approximately flat from 60 cycles to 15,000 cycles.

By regulating a resonant chamber in the rear of the cone the low-frequency response can be considerably accentuated if desired.

TELECASTS

WHILE holding out small hope that the FCC will favor the Columbia Broadcasting System's appeal to hold up black-and-white video standards until a bit more work is done on a color system, impartial observers are agreed that the CBS color process represents an enormous advance in the art.

Color definition is excellent and there is no apparent separation of colors on fast-moving objects. Also there is no noticeable flicker at the illumination level shown. The light output is considerably under that generally deemed necessary for viewing in a subdued-light room, although the illumination is more than adequate for a darkened room. The amount of flicker at greater brilliancies was not demonstrated.

As is usual in all presently-workable color video systems, a succession of three colored discs (here mounted on a rotating disc) pass between the cathode ray tube screen and the observer, each imparting its own color to the portion of the frame then being scanned.

Color Scanning Process

By a systematized order of scanning, the twenty complete frames are broken up into 120 fields per second, so that each color appears 40 times per second. This same system having been applied at the studio camera, all colors are reproduced in correct order and intensity. At the studio, however, particular color intensities can be modified or intensified if it is desired to correct for inaccurate intensities of the viewed scenes (as with filmed pictures) or to make drab scenes more vivid.

The rotating color wheel operates noiselessly and at a 1200 rpm speed carries six color film sectors—two red, two greens and two blues. Non-mechanical color systems (such as full electronic color methods) still seem to lie in the realm of wishful thinking, according to all available information.

The problems still to be settled, however, are those of coverage at the very high frequencies proposed by CBS, which are of an order that do not produce a utilizable signal behind hills or around obstructions. Locations in a valley may be without signals unless other obstructions are strategically located to "radar" a signal into the valley.

The possibility of using elaborate multiple arrays at a receiver to reduce reflected path multiple signals is not always an advantage, since simple dipoles alone that prove satisfactory at the present tele frequency range, are generally inadequate. These and other factors make it difficult to answer the question everyone is asking—will color supersede black-and-white immediately.

* * *

All video broadcasters are intensely interested in the development of good portable pickup equipment so as to simplify the relaying of spot news events into the homes of set owners and thus establish a reputation for immediate and accurate newscasting. Philco has a new "suitcase" type tele camera consisting of 35-lb. cameras and control units so designed that several cameras may be operated from a single portable master control.

In addition, both Farnsworth and Remington-Rand have announced portable pickup units that are expressly designed for spot news work. To date, however, the RCA Orthicon is far and away the best low-level lighting pickup, with dimly lighted interiors offering no bar to efficient pickup.

* * *

NBC prefers not to make its own films for telecast programs and will contract with established producers to provide them, states an official announcement. Deals will not be limited to any one producer.

* * *

Tie-in of films and tele planned by Balaban & Katz, owner of 135 movie theatres and tele Station WBKB in Chicago area. Will run trailers on current theatre attractions via tele and also equip several theatres for video reception.

* * *

Only 3% of families owning tele sets reported being at home without sets tuned in, says "Television" mag. Other facts adduced: lowest number of viewers, 4.6 per set; 66% of sets were "on" all or part of evening; peak audience was 7.1 viewers per set for one 15-min. period.

* * *

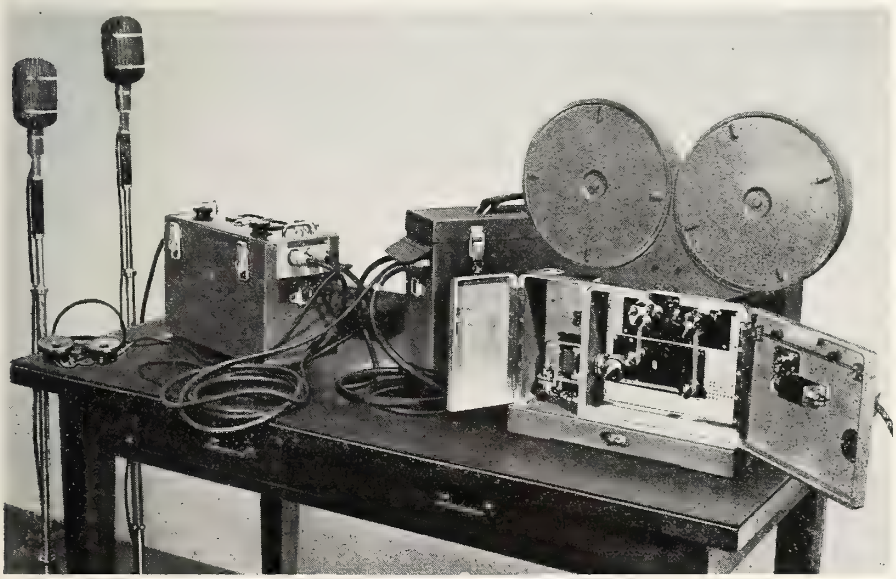
Estimates of 50 tele stations by end of 1946 are being halved due to material shortages and general uncertainty anent technical standards, centering mainly on current black-and-white vs. color battle.

* * *

Westinghouse reports "extremely satisfactory" first-flight tests of Stratovision system of video broadcasting, "usable signals having been transmitted over 240 airline miles from altitude of 25,000 feet using only 25 watts of power." (See "The Stratovision System . . ." in I. P. for Dec. 1945-Jan 1946 for detailed description of system.) Experiments in use of captive balloons for relaying tele signals now being conducted jointly by G. E. and Goodyear.

* * *

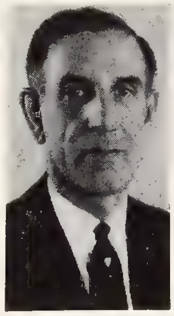
Staggering investment in video development was revealed at recent FCA meeting by following figures: Philco, 5 million; NBC, 3 million, and RCA, 11 millions. Latter two are corporate blood brothers.



The new Western Electric sound recording system, which will enable producers to record standard original or release-type of sound tracks on either 35-mm or 16-mm film. Shown above are (left to right) the new portable amplifier-noise reduction unit, power supply unit, and the recorder.

59th SMPE Convention Set For Hotel Penn., N. Y., May 6-10

The 59th semi-annual Technical Conference of the Society of Motion Picture Engineers will be held in New York City at the Hotel Pennsylvania, May 6-10 inclusive. All pre-war Conference functions will be reinstated at this meeting, including the traditional get-together luncheon on the first day, the dinner dance, and an expanded program for lady guests.



W. C. Kunzmann

The Papers Committee promises one of the finest programs in SMPE history, with many nationally known scientists already having submitted papers, some of which deal with heretofore top-secret war developments in the motion picture field. Committee reports will, as usual, feature the papers program. Deadline for the title and author of papers, together with an abstract, is April 1, and complete manuscripts are due not later than April 15.

Anticipating the largest attendance in the Society annals, convention chairman Bill Kunzmann emphasizes the necessity for addressing all requests for room accommodations early and direct to Joseph Troise, Front Office Manager, Hotel Pennsylvania, New York 1, N. Y., by April 25 the latest, being sure to mention the SMPE.

Out-of-town members who can schedule their New York arrival for Sunday, May 5, are more apt to get immediate room assignment than if arrival is on Monday, May 6. Room rates are as follows: single with bath, \$3.85 to \$6.60; double-bed room, \$5.50 to \$7.70; twin-bed room, \$6.60 to \$8.80; parlor suite for 1 or 2 persons, \$10 to \$18. With acute travel conditions still prevailing, early reservation therefor is imperative.

Cathode-Ray Tube Origin Dates Back to 1859

One of the first mentions of the cathode beam was made by Gassiot in 1859 in his paper "On the Stratification of Electrical Discharges as Observed in the Torricellian and Other Vacua," the quotation therefrom running as follows:

"In the tube . . . a discharge appears to emanate from the negative wire, issuing with great intensity from the orifice; and if the wire and tube are a little inclined, the discharge will impinge against the side of the vacuum tube, brilliantly illuminating the spot on which it impinges."

The tube in question was constructed with a glass shield round the negative wire, open at the end, and projecting about ⅛ in. beyond the wire.

Neither Gassiot nor Plucker, who published a paper in 1858 on the effect of magnets on the electric discharge, seems to have paid much attention to the negative discharge; but the position changed in 1869 when Hittorf published his series of papers on the conductivity of gases. His contribution was mainly concerned with the negative discharge (now called cathode rays), and he noticed the focusing effect of a magnetic field on a beam of the rays and the large potential gradient in the neighborhood of the cathode. Considering these achievements, it seems appropriate to call Hittorf the discoverer of cathode rays.

Riecke in 1881 published calculations on the path of a charged particle in a magnetic field, pointing out that Hittorf's experiments could be explained by assuming the cathode ray to be a stream of such particles moving with uniform velocity.

The idea of atomistic electricity was first announced by Johnstone Stoney in 1874, and it is to him that we owe the name "electron" for the atom of negative electricity.

RCA Adds New Test Reel

A new theatre sound test reel, made up of selected portions of features made by major studios and released by the Academy, had been added to the standard equipment of all RCA theatre service engineers. The reel is designed to facilitate adjustment of sound systems for best overall results.

CALIFORNIA DISTRICT COUNCIL NO. 2 MEETING CLOSES WITH BANQUET FOR DELEGATES AND GUESTS

Present at the steak dinner tendered the delegates and guests of the Council at the close of its recent quarterly meeting were representatives from many Southern California I. A. local unions.

Standing, left to right: Charles Collins, sec.-treas. San Diego Local 297; R. W. Barrigan, Council vice-pres., and bus. rep. El Centro Local 656; Harold Angel, Los Angeles Local 150; Charles A. Vencill, sec.-treas. Los Angeles Local 150; Alonzo S. Bennett, Council sec.-treas., and sec.-treas. Long Beach Local 521; W. W. Wise, Council pres., and bus. rep. San Diego Local 297; W. G. Crowley, pres. Los Angeles Local 150; Geo. J. Schaffer, bus. rep. Los Angeles Local 150; Sidney Burton, chairman, 16-mm committee for Los Angeles Local 150; Sid Sampson, attorney for Los Angeles Local 150, and S. LaPrade, pres. San Diego Local 297.

Seated at left tables, reading clockwise: H. C. Reynolds, Hollywood Local 165; John Venema, sec. Ventura Co. Local 709; Walter McCormack, Hollywood Local 165; Richard Hennley, sec. Hollywood Local 165; Jim Eddy, bus. rep. Hollywood Local 165; Don Freiling, pres. Hollywood Local 165; Visitor; Pat Offer, Hollywood Local 165; L. A. Ward, vice-pres. Long Beach Local 521; Rudy Trotter, sec. Local 720; Robert Bennett, San Bernardino Local 577; Basil Davis, bus. rep. San Bernardino Local 577; E. L. Covington, Long Beach Local 521; Hal Huff, Los Angeles Local 150; G. A. Lahlum, bus. rep. Long Beach Local 521; C. Guinan, Don Rudd, and Harold Roddan, Hollywood Local 165; Visitor; Carl Cooper, I. A. vice-pres.; John Gotchel, sec. Santa Barbara Local 442; W. L. Coleman, sec.-treas. Santa Ana Local 504; Jack Payne and Harry Shiffman, Hollywood Local 165.

Seated at right tables, reading counter-clockwise: H. Jaffee, Hollywood Local 683; Visitor; Norval Crutcher, sec.-treas. Hollywood Local 683; Visitor; Visitor; Visitor; J. Nelson, Chula Vista Local 761; L. J. Musser, bus. rep. Chula Vista Local 761; Jimmy Thompson and Neal Fairbanks, Hollywood Local 695; W. R. LaBar, pres. Long Beach Local 521; Ray Haskell, Los Angeles Local 150; Red Edinger, T. Piper, M. Pylet, T. Neilson, N. Spicer, Los Angeles Local 150; Ted Ellsworth, bus. rep. Hollywood Local 705; Herb Aller, bus. rep. Hollywood Local 659; C. Brier, Hollywood Local 659; Visitor; John Martin, bus. rep. Hollywood Local 683; Visitor; Visitor; Howard Neece, bus. rep. Ventura Co. Local 709.

AT YOUR SERVICE

This department is devoted to the man behind the man behind the gun—the serviceman. Its prime purpose is to promote a closer relationship between projectionist and serviceman based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. Contributions from both groups are invited.

HERE is an effective method for testing wet electrolytics. The reason for the failure of these condensers seems to be a thin dielectric film which forms at the junction of the aluminum anode and the supporting rod. The unwanted film can be removed by connecting the condenser in series with a 60-watt lamp across the 220-volt AC lines. Usually nothing happens for several minutes. Then the film suddenly breaks down, causing the electrolytic to sizzle and the lamp to light.

The power should then be switched off and the condenser rejoined by connecting it to a DC supply of several hundred volts for about ten minutes, after which it will generally be found that the condenser has acquired a new lease on life. Obviously, if there is no electrolytic in the condenser to start with, this method will not work.—A. L. FRIEL, *RCA.*

Cleaning Volume Controls: Wire-Wound and Stud-Contact Types

Noisy operation of the more troublesome controls can effectively be eliminated by first cleaning all contacts with tetrachloride, drying, then polishing with crocus cloth, followed by wiping with a clean soft cloth. After this the control can be lubricated with approved oil or left dry.—R. H. BISBEE, *RCA.*

Testing Power Unit Capacitators

A quick check on these is to connect a voltmeter across the one being checked and remove the capacitator fuse, the efficiency can then be judged by the time the voltage remains constant. — C. M. KASEY, *RCA.*

Simple Pre-Heat Winding

A pre-heat winding can be added to an existing power unit by winding one and

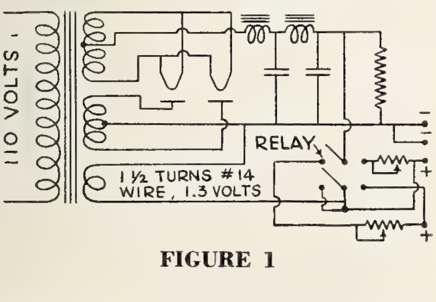


FIGURE 1

one-half turns of No. 14 wire on the power unit transformer and connecting it up as shown in Fig. 1.—R. O'TOOLE, *RCA.*

Prolonging Life of Pad Roller Arms

For pad roller arms of MI-1040 and similar soundheads using single rollers, periodic interchanging of upper and lower arms is suggested. These arms sometimes become sprung due to repeated lifting, by the outside end of the roller shaft, with a "heavy hand". However, they are sprung in an opposite manner; and periodic interchanging will generally be effective in maintaining the proper relation between sprocket and roller at both ends.—C. D. WELSH, *RCA.*

Replacing PS-24 Oil Seals

To place oil seals on armature shaft of PS-24 soundhead without the use of a tool, use two turns of wrapping paper over the sharp shoulder to prevent leather seal from being gouged out.—E. J. DUSTIN, *RCA.*

PS-24 Soundhead Latching Plate

When the pressure roller latching plate of a PS-24 soundhead has been reversed and is worn so that it latches erratically, I have found that a dressing down with a file on both face and edge, plus two thin washers under the mounting screws, will restore a badly worn plate to satisfactory service.—WILLIAM S. REASIN, *RCA.*

Marking Dates on Tubes

A china marking pencil can be used to mark tubes when they are installed. Install tube and let it become hot, then mark date, month, day and year. The color will melt and bake on if the tube is hot.—R. H. HECHT, *RCA.*

Emergency Amplifier Use

I have found it advisable when using the PG-169 emergency amplifier on systems having exciter lamp changeover, to parallel the input of the phototube network, thus eliminating the PEC changeover switch on the PG-169.

When this is done all that is necessary at changeovers is to operate the exciter changeover switch.—N. SPOCK, *RCA.*

Coupling a Grounded Pickup to a Balanced Input

A quick and easy way to couple a grounded phono pickup to a balanced input system is to use an output transformer having the customary 4, 8, 15 and 500 taps. Correct input level may be

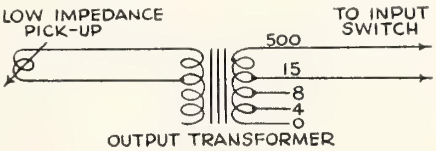


FIGURE 2

chosen without resistor pads, and since the mismatch is always a low impedance feeding into a higher impedance, no serious loss of quality is noticed (Fig. 2).—FRANK ADAMS, *RCA.*

Cleaning W.E. Fader Contacts

As a general condition, I have found that in dismantling the wiper blades on fader types 702, 703, and 705 and thoroughly cleaning or resurfacing these blades and the contacts with crocus cloth; then following this up by wiping with a clean cloth and lubricating with vaseline, eliminates hard-to-get-rid-of hum and improves the brilliance of sound reproduction.

In re-assembling the wiper blades, care should be taken in tightening the blade assemblies: some types of faders have metal separators between the blades, while others are composed of bakelite materials. Proper tightening of the wiper blades insures a firm wiper-action.—LEO CIMIKOWSKI, *RCA.*

Alignment of Projector Heads

The use of a small straight-edge for checking projector head alignment is a big help in film weave troubles. By placing the straight-edge across the face of the steel drive gear, the fibre gear should then be perfectly parallel as sighted by eye.—G. H. BLEEKER, *RCA.*

IN THE SPOTLIGHT

(*Continued from page 19*)

of the local, was elected president of the Trades and Labor Council at Medicine Hat.

Our Canadian brothers seem to be very much to the fore in labor matters.

● The dual-union situation that has long been a source of much concern to I. A. local unions in District Number Twelve (Canada) has been completely eliminated, largely through the efforts of Bill Covert, I. A. vice-president and business agent for Toronto Local No. 173. Covert recently signed contracts with J. Arthur Rank's Queensway Studios and is at present negotiating new contracts with the theatres in his jurisdiction for Projectionists' Local No. 143 and Stagehands Local No. 58.

● M. Berinsky, well known to readers of I. P. as the author of the extremely popular series of articles, "Basic Radio & Television," and instructor in these subjects for many members of New York Local No. 306, is now engaged in television service work for factory, dealer, and consumer. Together with M. Seligsohn, also an instructor of electronics, Berinsky has formed a partnership under the name of Certified Television Service Co., 5507 Thirteenth Ave., Brooklyn, N. Y., which will also prepare radio and television kits to be used by schools and other organizations for educational purposes.

● Last month we mentioned herein the plans of the New York Central Railroad to show motion pictures on their new trains next Fall. We learned recently that pictures will also be shown on transcontinental planes. Just as soon as the airline officials determine what rating and pay to offer they will open negotiations for projectionists on the transcontinental flights. This is another tip to alert union officials whose jurisdictions cover airports.

● Thomas A. Reed, William M. Sheehan, and T. DeWitt Bittenbender, members ot Washington, D. C., Local 224, were elected delegates to the Maryland State and District of Columbia Federation of Labor Convention which will be held in Cumberland, Md., May 13.

● Howard Wm. Keithley, charter member and former officer of Local No. 224, Washington, D. C., died at his home several weeks ago. Keithley was one of Warner Brothers oldest employes and at the time of his death had been working at the Penn Theatre. A part of Washington's show business since 1911, he will be remembered for his many contributions to the motion picture industry. He is survived by his widow and two children.

● Al Attora, projectionist at the Roxy Theatre in Springfield, Ill., and a member of Local No. 323, has been elected commander of the local branch of the American Legion.

STRONG'S GLASS BOUND BOOK

It was to be expected a glass bound book would sooner or later make its appearance and fitting that it should emanate from the glass city—Toledo. Such a book, Strong Reflections, the story of the production of projection arc lamp reflectors, is now being distributed to theatre supply dealers by the Strong Electric Corp.

The front glass cover bears a reproduction of an arc lamp reflector, the back of the glass being silvered to give the reflector the appearance of a real mirror.

Pyrene Products to NTS List

National Theatre Supply Co. has been named the exclusive distributor in the theatre field for the fire protection devices of Pyrene Mfg. Co. and its affiliate, the C-O-Two Fire Equipment Co. During the past four years practically all firefighting equipment has gone to the armed forces. Pyrene's line includes vaporizing liquid, foam, soda-acid and water extinguishers, while C-O-Two makes the carbon-dioxide type.

Ample stocks are on hand now at all N.T.S. branch offices.

W. U. CONCENTRATED-ARC NOT FOR PROJECTION

(Continued from page 16)

has other deficiencies for this application.

Operating data reveal that the W. U. 100-watt lamp produces 77 candlepower. This means that, on the basis of the 90° pickup angle previously referred to, the lamp produces 121 lumens overall, or 1.2 lumens per watt. Assuming that the light distribution could be increased to cover a pickup angle of 140° (obviously quite an accomplishment considering lamp structure) the arc would produce 214 lumens, or about 2 lumens per watt.

Comparison of these figures with those applicable to the Suprex 8-mm x 7 carbon arc pulling 65 amperes at 38 volts is devastating to the prospects of the W. U. lamp as a film projection light source. This carbon arc trim produces 77,000 lumens within the 140° pickup angle, or 31.2 lumens per arc watt! On a comparable wattage basis the W. U. lamp would produce 5,200 lumens, which represents no appreciable gain in lumens per watt.

Significantly, these figures involve no consideration of mechanical and electrical changes necessary to enable the W. U. lamp to operate on any such comparable basis of wattage and pickup angle, if, indeed, such changes are possible by reason of the inherent structural and operating characteristics of the zirconium lamp. Comparative figures used herein, therefore, have been on a basis extremely favorable to the W. U. lamp.

Other carbon arc trims provide similarly interesting data. The popular 1-kilowatt arc using a 7-mm x 6 trim and pulling 40 amperes at 27½ volts produces 35,000 lumens within the 140° pickup angle, or 31.8 lumens per arc watt. The 6-mm x 5 Pearlex arc produces 23,000 lumens, or 27.4 lumens per arc watt. Naturally, all figures cited herein refer to light produced at the arc.

Larger Lamp Requisites

Conceivably, larger W. U. lamps operating at higher power levels might be developed: in fact, a 1500-watt zirconium lamp is now in the experimental stage undergoing test runs. The efficiency rating of such a high-power lamp, however, judged on the basis of data adduced with the smaller sizes, cannot possibly compare favorably with the carbon arc.

Certain it is that the power packs necessary for larger size W. U. lamps would have to be prohibitively large and economically impractical to approach the efficiency level of the carbon arc. The efficiency of such power units, indicated by available data anent the smaller lamps, would be quite low—certainly not above 50% in terms of watts drawn from the power source.

Also, observation of the 1500-watt lamp now being tested indicates that some method of cooling, probably water-cooled jackets, will be necessary. This is not an insurmountable problem, of course, but it might constitute a definite problem in smaller communities.

Measurements show the brightest part of the W. U. luminous spot to be near the center and (we quote from W. U. data) "variations in the position taken by the arc stream and irregularities in the cathode surface may produce an unsym-

metrical and changing brightness distribution across the spot. Also, the spot position may shift slowly during operation by an amount equal to a small percentage of its own diameter. These factors combine to produce variations of about 10% in the brightness and total light emitted. For most applications these effects are of no importance, but for some special uses requiring unusual stability, they may have to be considered."

Spectrally, the light distribution of the W. U. lamp appears to be definitely inferior to that of the carbon arc; in fact, it approximates to a great extent the spectral characteristics of tungsten-filament incandescent lamps. This factor is of prime importance.

Another important consideration is that the W. U. lamp gives little if any effective warning that it is about to burn out. W. U. engineers assert that one is warned of impending burnout by the increasing difficulty experienced in "striking" the arc, but this hit-or-miss basis of calculating lamp life is hardly compatible with existing standards of film projection in America, where an interruption of even the few seconds necessary to turn a turret holding two or more lamps is intolerable.

Summing up, it appears that the W. U. concentrated-arc lamp, considered on the basis of how much light of what quality for how much money (the latter term embracing lumens-per-dollar) definitely does not meet the requisites for efficient motion picture projection, including the professional 16-mm field.

British Equipment Group in American Market

GB-Kalee, Ltd., old-line prominent British film equipment house, will open a branch in Toronto, Canada, in the near future, marking the first serious threat to U. S. equipment manufacturers in the American market. Kalee is a subsidiary of the J. Arthur Rank organization which controls extensive producing, distributing and manufacturing properties in England. The Rank interests recently launched an American producing unit.

The Kalee announcement said that "available British equipment would be supplemented by suitable American accessories," which statement sheds little light on degree of preference to be accorded British equipment.

Earnings, Dividends Reports

Radio Corporation of America directors have voted a dividend of 87½ cents on the outstanding shares of $3.50 cumulative first preferred stock for the first quarter of this year. Payable on April 1 to stockholders of record on March 11.

• • •

Western Electric earnings, including subsidiaries, amounted to $15,126,000 in 1945, compared with $13,858,000 for 1944. Earnings amounted to less than 2 per cent of total sales of $860,713,000.

• • •

Stanley Co. of America, large exhibitor chain centering in Penna., announces a net profit of $2,624,040 for the year ended Aug. 31, 1945, reflecting a net gain of $1,149,351 for the same period in 1944. Dividend payments in 1945 were $1,357,269. Current cash assets are $1,943,055. Parent company is Warner Bros.

• • •

Famous Players Canadian, far-flung Dominion exhibiting group, reported net profit of $1,594,973 for year ending Dec. 31, 1945, bettering the previous year by $223,348. After dividend of 15 cents per share payable March 23 to holders of record March 9, the earned surplus account was increased approximately 1 million dollars to $7,798,266. Present working capital is $2,187,143.

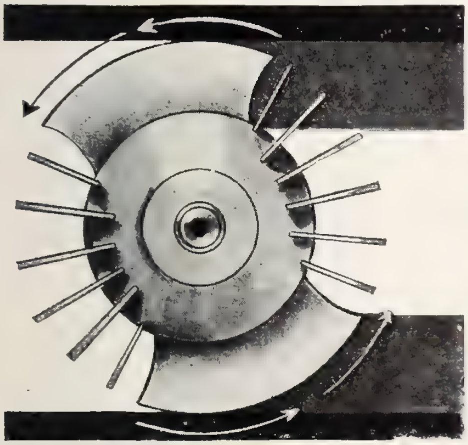
Equipment Show at N. J. Allied

Twenty-one prominent equipment manufacturers have already signed exhibiting contracts for the Allied Theatre Owners of New Jersey convention in Atlantic City, June 1921.

THE CYLINDRICAL SHUTTER

(*Continued from page 15*)

not apply to this shutter, and for two reasons: (1) it is located closer to the projector aperture and consequently has a smaller beam diameter to cut; (2) the shutter is positioned horizontally or



Side view of the Motiograph cylindrical shutter, showing double cut-off of the light beam.

transversely of the beam, the light passing through its center or cylinder so that when one blade is cutting down through the beam, the other is cutting upward, the two interacting at the beam center. Only half the time is required to cut off the light that would be necessary were only one blade in active operation.

The Motiograph horizontal rear shutter is shaped at each end of the cylinder to act like a fan or air propeller. From each end air currents are directed toward the center of the cylinder. Each of the two blades of the cylinder has a transverse vane, which, in combination with the propeller ends, sets up air currents and draws them in through the opening of the shutter housing toward the lamphouse. This draws air over the metal of the projector mechanism around the film gate, keeping it and the film at relatively lower temperature and preventing deposits of dust.

It will be seen from the foregoing that the projector mechanism employing double shutters gives more light on the screen and consequently a better picture than the single-shutter types. In order to accomplish this result, the double-shutter mechanism requires more materials, more skilled engineering, and more gears and other mechanical components.

Therefore, while it would obviously be worth more money, the prospective purchaser of a pair of projector mechanisms who is interested in top-flight picture presentation for his patrons will do well to select from the four double-shutter types. It is true that three projector manufacturers still make single-shutter type mechanisms, probably because there are some theatre owners who consider only price when buying equipment; but it is equally true that they recommend more highly their more modern and superior double-shutter types.

Projector Life Factors

Every manufacturer of double-shutter type mechanisms makes the claim that their own particular product puts as much, if not more, light on the screen than that of any of their competitors. As a matter of fact, the writer believes

that the difference, if any, is infinitesimal when all projectors are brand new. The choice of which mechanism to buy accordingly should rest in those factors which have a direct bearing on long-term correct shutter operation.

Shutters are connected by means of shafts and gears to the other components of the projector mechanism. If there be unusual wear on these shafts and gears, it will create lost motion in the gear train that will bring "travel-ghost" to the screen. Most manufacturers have a provision for adjusting the shutters in order to eliminate this "ghost."

On some machines these adjustments consist of widening the shutter blades, which, of course, means a marked loss of light as the projector mechanism ages. The projector mechanism with a gear train consisting of, for example, hardened steel and bakelite gears is capable of much longer operation without adjustment than is one employing soft iron gears. Projectors like the Motiograph Model K, which have adjustments to take up wear in the shutter gear train, thus not requiring a change in the width of the shutter blades, will continue to give maximum light on the screen for the full life of the projector.

While all double shutters located between the light source and the aperture make possible a cooler aperture than a single rear or front shutter, there are some types of double shutters which make possible cooler apertures than do others. The prospective buyer should check the heat factor very carefully, as it has an important relationship to projector life.

For more detailed technical information on the subject of shutters, the reader is referred to standard text books and other technical literature. Manufacturers of projection equipment will be glad to furnish data on the care, operation and adjustment of their respective products.

NEW GERMAN PLASTIC TAPE

Further data anent a German-developed recording and playback equipment, considered superior to any used heretofore, has been released by the U. S. Army. The unit uses a thin tape of a plastic base which, costing $3 a roll, plays for 20 minutes.

In operation, the tape passes through the gap of a small magnetic armature with the surface bearing the oxide in contact with the armature. Recording and playback is accomplished in the usual way, and there is a wipe-out mechanism enabling the tape to be used again. At the regular tape speed of 80 cm/sec., it is said that the instrument will record and reproduce frequencies as high as 10,000 cycles, and the normal range is from 20 to 8,000 cycles.

In 1943-44 the production was 6,000 tapes per month. No deterioration in recording has been experienced, surface noise is negligible, and the tape can be easily edited and spliced.

EXTEND RACING 16-MM FILMING

Motion picture coverage of horse races to aid stewards in making decisions, adopted by Hollywood Park and Santa Anita, will be extended to Eastern tracks with the system slated for both Arlington and Washington Parks in Chicago, it is announced by Telefilm Studios of Hollywood.

Under Telefilm control, 16-mm cameramen atop six towers around the course take pictures of the horses from starting gate to finish line. The films are developed and ready to be shown in a projection room under the grandstand within seven minutes after finish of a race.

Presenting: W. H. (Lou) Clendening

ATLANTIC CITY has long been known as the "Playground of the Nation" (Florida and California dissenting), but for more then 40 years it has been just a place to live and work in for William H. Clendening, a fugitive from Philadelphia, where he was born in 1895. That "William H." tag is strictly legal palaver, because "Lou" it is and always has been to thousands of I. A. men.

Lou's show business career began 'way back in 1910 when, at 15 years of age, he became assistant property "man" at the old Savoy Theatre. This affiliation wasn't formalized in the Clendening book, however, until 1919, when he became a member of I. A. Local 77.

Previously, however, and probably by way of training for his initiation into Local 77, Lou accepted a gracious invitation to a boatride to a place called France, along with a gang of mugs known as the 9th Infantry of the Second Division, U.S.A. This France must be a rough country because in a cove known as St. Mihiel a stranger ups and from afar slugs Lou with assorted pieces of steel. After which, l-o-n-g after, two guys, one Belgian and one French, up to Lou and for the privilege of kissing him on both cheeks (singly, mind you), handed him a couple of engraved coin-machine slugs known as Croix de Guerre.

Surviving this humiliation, Lou arrived back home and, reflecting that show business held no comparable terrors, sought the protection of Local 77. A year later, in 1921, he was elected president—and president he has been continuously for 25 years right down to the present.

Don't you projectionists hold that against him, however, for Lou has since done penance. Observing the regal raiment and lordly bearing of sound-picture projectionists during the early '30's, Lou applied himself diligently and in 1931 went to work as a projectionist in the Warner Theatre, a post he has held for the past 15 years.

Mr. I. A. of Atlantic City

Then what do you think happened? You guessed it: Mr. William H. (Lou) Clendening is now serving his seventh term as president of *projectionists'* Local 310 of Atlantic City, the "Playground of..." (aw, never mind). So, if you wish to discuss stagehands in A. C. you see a guy named Lou Clendening. But if you wish to discuss projectionists you see a guy named Lou Clendening. Sounds involved, but it's really simple.

Lou has also served his International on a broader scale. He was I.A. delegate to the A. F. of L. Convention for the 1932-34 term, and he has also acted as special I. A. representative on numerous occasions in many difficult situations. Lou's I. A. Convention name is "Mr. Parliamentarian," because his wide and intimate knowledge of "the book" is accepted as gospel by all concerned. A candidate for I. A. vice-president at the 1944 Convention, Lou received an extremely-large vote in a hotly-contested election.

But the payoff is saved for the last. Serving as Labor's representative on the A. C. Ration Board, Lou was chairman of the Tire and Tube Panel. Oh, brother!

Sound Speed at 30,000 Feet

The jet plane which flew from Dayton to New York in an hour, was announced to have a speed of 550 miles per hour, nearly the "speed of sound." At 30,000 feet, the plane's usual height, sound has a speed of 680 miles per hour, compared with 750 miles per hour at sea level.

PERSONNEL

W. W. Gilreath, well known in the New Orleans area for his work as RCA service representative, has ben named Disitrct Manager for RCA in the Dallas district. He will relieve C. E. Johnson, who will join the RCA home office staff at Camden, N. J.

• • •

DeVry Corp. has announced several important executive assignments. William R. Sokel, named sales manager of the 35-mm motion picture division, formerly handled the design, procurement and distribution of all types of sound projection equipment for the Navy, Marine Corp. and Coast Guard.

L. M. Anderson, who served DeVry as chief expediter and assistant production manager during the war years, has been named 16-mm industrial sales manager. Anderson formerly was active in the Atlanta, Minnesota and Dakota areas.

Norman D. Olsen, Jr., has been named assistant export manager, in which spot he will aid his father, who has the same name.

• • •

Robert H. Unseld, recently returned from military service, has resumed his civilian activities as general advertising manager of Bell & Howell Co. His career with the company dates back to June, 1935, when he resigned his post as American Vice-Consul at Surabaya, Java, to become manager of B. & H.'s personal equipment division. Within two years he was assistant advertising manager, and in 1939 he was named general advertising manager, which position he held until called to active duty with the Air Corps.

• • •

Capt. Frank H. Riffle, USA Signal Corps, has rejoined Altec in the Cincinnati area, resuming work he started with Erpi in 1929. Since 1943 Capt. Riffle has seen service in the Mediterranean and European areas as radio operations officer in which capacity he contributed to numerous improvements in radio teletype operation. He served overseas 32 months. .

• • •

Harry S. Millar, of New York City, has been named Eastern district manager for Radiant Projection Screens. Millar, active in the field since 1929 and former district manager for Ampro Corp., for the past three years has been director of the American Red Cross hospital motion picture service.

Jack Newman, of San Francisco, after four years in the Army, has been appointed Western district manager for Radiant Projection Screens. He will aid dealers in California, Washington, Oregon, Idaho, Utah and Arizona in screen merchandising and development of new markets, and will also be available for lecturing to camera and movie clubs.

• • •

Walter M. Reynolds, information manager of A. T. & T. Co. since May, 1944, has been appointed publications manager for Western Electric Co. He is succeeded at A. T. & T. by R. I. Johannesen, editor of the "N. Y. Telephone Review."

• • •

Nat Golden, head of the Motion Picture Section, U. S. Dept. of Commerce, has returned from Germany where he served as head of a commission which investigated German technological advances, notably the one-shot colorfilm process developed by Agfa. This process, providing full color through a one-shot camera and developing procedure, is reportedly not superior to Technicolor. Commercial possibilities of other German developments were investigated and analyzed.

Golden is a long-time member of Cleveland Local 160.

• • •

J. E. Miller, associated with RCA since 1931 except for the war period, has been named theatre equipment sales representative in Los Angeles. Miller was connected with the RCA Hollywood office in the early days, and before the war was RCA theatre equipment salesman in Seattle.

• • •

Jack O'Brien, assistant sales manager of RCA's Theatre Equipment Section, recently became the father of a 7½-pound boy, Jimmy. Jack and Mrs. O'Brien also have a daughter, Kathleen, who is 5.

• • •

Joe Robin, nationally-known theatre equipment man and former president of the Dealers' Association, is recuperating from a major operation at New York City's Polyclinic Hospital.

70% U. S. Houses Play Duals

Severe curtailment in the number of feature releases during the past four years failed to make any dent in the double-feature policy of most theatres, with reliable data indicating that more than 70 per cent of America's theatres still play duals. Print shortage was aggravated by extended playing time of first-runs which attracted heavy war-pay play.

25-30 Club Notes

IN RECOGNITION of his splendid work in encouraging cooperation and friendship between service engineers and projectionists. Bert Sanford, New York district manager for Altec Service Corp., will be feted by the 25-30 Club at a testimonial dinner at the Grand Street Boys Clubhouse on May 6. At the dinner Sanford, together with Harold Rodner, director of personnel for Warner Bros., will be made honorary members of the Club and presented with silver membership cards.

Bert Sanford

Also, a $500 bond, which was given to the 25-30 Club by Mrs. Arthur Lichtenstein, widow of the Club's founder, for some charitable institution of its choosing, will be donated to the Will Rogers Memorial Hospital at Saranac Lake, N. Y. The bond will be handed to Harold Rodner, who is executive vice-president of the Rogers Hospital Fund.

In addition, the Club will donate ten $25 bonds to be used as prizes in a competition at the Old Farms Convalescent Hospital for blind veterans of World War II at Avon, Conn.

Project Michigan 16-mm Circuit

Jack S. Leysten, operating the Leysten Studios in Muskegon, Mich., is reportedly ready to establish a circuit of 16-mm film theatres throughout Michigan.

24 Cameras, 3,000 Pics a Second

A battery of twenty-four high-speed motion picture cameras will take 3,000 pictures a second of the forthcoming atomic tests off Bikini atoll, the Eastman Kodak Co. has announced.

Movie Receipts Top '45 by 15%

Movie box-office receipts for the country as a whole are averaging 10 to 15 per cent above those of a year ago, reports the *Wall Street Journal*, with current quarter profits of producer-distributors at a new high level. Paramount earnings for 1946 are estimated at 18 millions.

U. S. Asks Aid Re: Nazi Data

Faced with the task of microfilming tons of captured German technical data, the U. S. Dept. of Commerce asks the assistance of all industries and scientific societies in suggesting specific information desired.

New 'Butt Splice' Unit Is Offered by NTS

A unique method of splicing film is utilized in the Jeff Speed Splicer recently obtained by National Theatre Supply Co. for distribution. Sturdily built and nicely finished, with all film-contacting parts of polished stainless steel, the Jeff Splicer makes unnecessary the scraping of film emulsion and the overlapping of film ends.

Pulling splicing strip through die.

This "butt splice" is accomplished by the use of a transparent strip of film which, contained in a roll at the rear of the splicer and fed into the splicer handle, binds the two straight edges of film that have been previously joined end to end and held rigidly in place by film trap covers.

Just prior to the final downward sealing motion of the splicer handle, or die, the adhesive agent is applied in one sweeping motion across the joined film ends. The die then descends, the transparent film is applied and held to the film ends for ten seconds, and the splice is made.

Sponsors of the Jeff Splicer assert that their method insures a stronger, faster splice which is much quieter in the projector, without the need for losing a single frame if the film is undamaged. The unit contains a pilot light and a built-in cement holder.

I. A. Elections

CALIF. DISTRICT COUNCIL NO. 2

W. W. Wise, *pres.;* R. W. Barrigan, *vice-pres.;* Alonzo S. Bennett, *sec.-treas.;* A. V. Narath, B. H. Davis, L. J. Musser, *trustees;* Jimmy Thompson, *sgt.-at-arms.*

LOCAL NO. 108, GENEVA, N. Y.

Francis E. Larham, *pres.;* Jos. H. Hartley, *vice-pres.;* Chas. F. Wheeler, *sec.-treas.;* Allen S. Grant, *bus. mgr.;* Chas. F. Wheeler, *del. State Convention;* Francis E. Larham, *del. I. A. Convention.*

LOCAL NO. 186, SPRINGFIELD, MASS.

Benj. G. Hull, *pres.;* Edw. Whittle, *vice-pres.;* Arthur J. Payette, *sec.-treas.;* Louis L. Williamson, *bus. agt.;* Jos. C. Rodriguez, *sgt.-at-arms;* Howard B. Smith, Herbert Binns, Owen M. Holmes, *exec. board;* Jos. C. Rodriguez, Benj. G. Hull, Louis L. Williamson, Arthur J. Payette, Edw. Whittle, *del. to Springfield C. L. U.;* Benj. G. Hull, Louis L. Williamson, Horace L. Bassett, John Morris, Emile Bessette, *del. to Westfield C. L. U.;* Arthur J. Payette, Louis L. Williamson, *del. to I. A. Convention;* Benj. G. Hull, *alternate del. to I. A. Convention.*

LOCAL NO. 301, NEW BRITAIN, CONN.

Howard K. Richardson, *pres.;* Howard E. Williams, *vice-pres.;* Frank Charbrella, *rec.-sec.;* Edward Regula, *fin.-sec.;* Fred Matthews, *bus. rep.*

NEW NATCO 16-MM PROJECTOR

National Industries, Inc., of Chicago and New York, has announced a new Natco 16-mm sound projector. Functional highlights include direct sound scanning, independent floating stabilizers, a highly efficient ventilating system, and a precision-designed mechanism.

A triple-claw shuttle movement allows film to feed through the projector even when two consecutive sprocket holes are defective. Damage caused by film weave is eliminated due to the position of the sprocket teeth in relation to the picture frame. All lamps are readily accessible for changing, and the film gate components are quickly removable for easy cleaning, without tools.

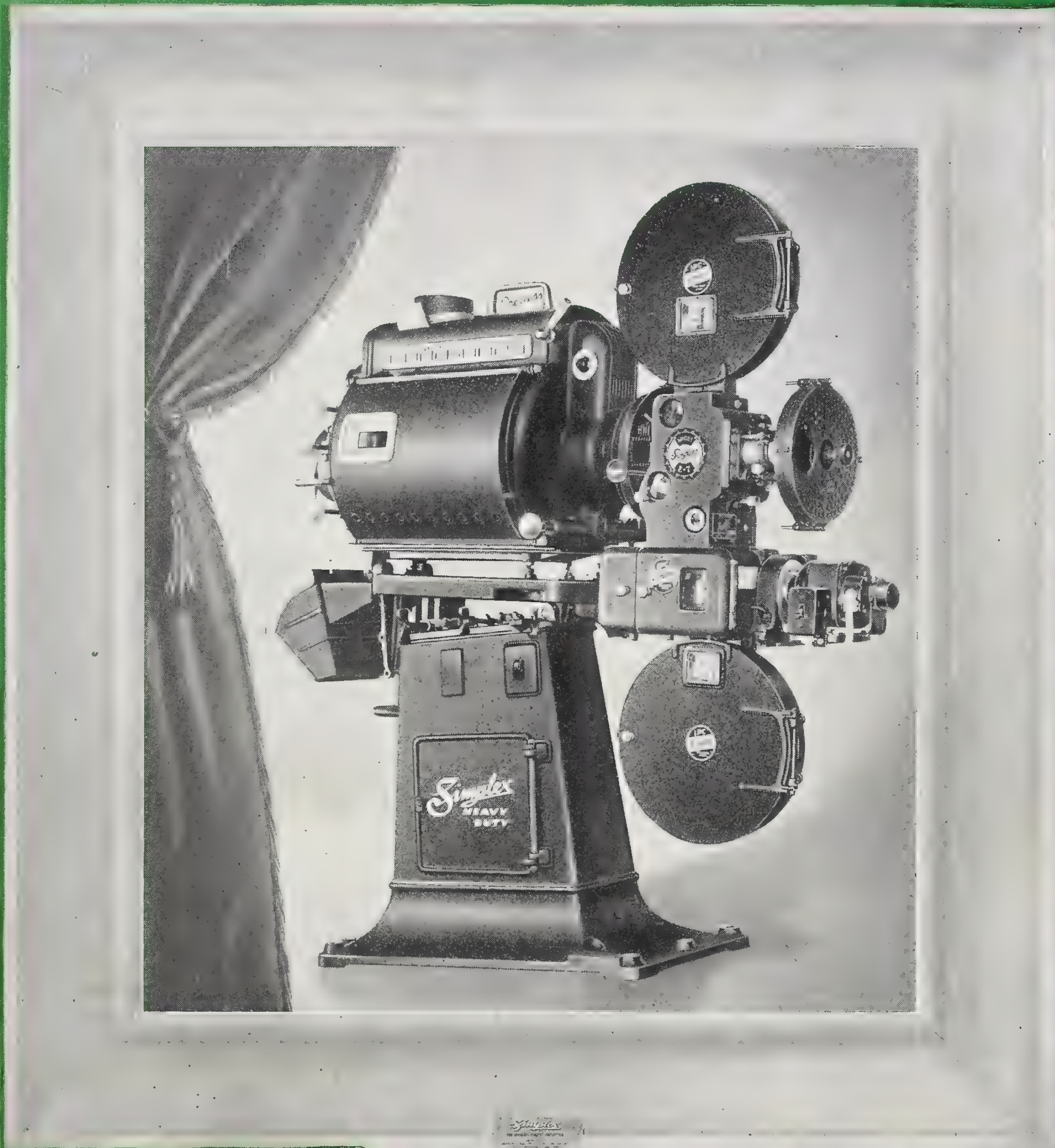
The Natco is equipped with a coated F 1.6. lens, has a 12-inch permanent magnet speaker with a power output of 18 watts. It handles up to 2,000-foot reels, and there are no belts or arms to attach. Rewinding is done by simply turning the rewind switch without changing the reels. Standard equipment includes a 15-foot power cable, 50-foot speaker cable, extra exciter lamp, fuses, a 1,600-foot reel, lens tissue, lubricating oil, and a set of Allan wrenches. The unit carries a two-year guarantee against defective workmanship and material.

Service has been simplified by individual assemblies and sub-assemblies, each of which can be removed and replaced immediately in the field, using ordinary tools.

ALTEC MEN AT REGIONAL MEET

(Top) Altec district managers take time out to be photographed with vice-president H. M. Bessey. Seated, left to right: Bert Sanford, Jr., New York City; H. M. Bessey; L. J. Hacking, Boston. Standing, left to right: D. A. Peterson, Philadelphia; Warren Conner, Cincinnati; H. B. Moog, Atlanta.

(Bottom) Group of Altec headquarters staff who attended the recent regional meeting of service managers at the Park Central Hotel, New York City. Seated, left to right: E. O. Wilschke, assistant vice-presiident; C. S. Perkins, manager, commercial engineering; E. Z. Walters, comptroller. Standing, left to right: P. F. Thomas, treasurer and merchandise manager; W. W. Simons, manager, advertising and publicity; Martin Bender, systems engineer.



INTERNATIONAL PROJECTIONIST

MAY 1946

VOLUME 21 • NUMBER 5

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Guessing can be expensive

Guessing can be expensive at any time but particularly so today with the present limitations on new projection room equipment and with the uncertainties of replacements. Every projectionist should know the whys and wherefores of his equipment. He should know what to do and what not to do when the equipment fails to function properly—and how to keep the show going until the service inspector arrives at the theatre.

PROJECTIONISTS' SERVICE MANUAL is a complete, compact compilation and a valuable reference work. All items therein are grouped according to classifications and contain sound practical suggestions relating to the many projection room troubles—their causes and how to remedy them.

A copy of this valuable trouble shooter should be in every projection room for instant reference and as a trouble guide. Many I. A. local unions have ordered this book in bulk and placed a copy in each projection room. The price is right—only $3 per copy, postage prepaid. Order your copy now or ask your local union secretary about our special low-price bulk offer.

Send for it Now! *Do Not Delay*

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19 West 44 Street, New York 18, N. Y.

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INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

HENRY B. SELLWOOD, *Editor*

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MONTHLY CHAT

ONE need give only cursory attention to the papers program presented at the recent SMPE Technical Conference to be deeply impressed by the breadth of technological development within the past decade. Superficially, the production and exhibition of motion pictures would seem to be following the well-worn path of twenty years ago. But there are factors and forces at work which, like sound pictures, have already left a deep impress on motion picture technique and promise to effect even more drastic changes in the near future.

Our chief concern anent technological change—indeed, the only reason for being of a craft journal such as I. P.—centers on the question whether the projectionist craft is exerting a sincere effort to keep its head above the currently heaving seas of technology. Equipment and technique are not the only casualties of obsolescence; complacency, plain indifference can wreak havoc with the mind and in short order reduce it to a state akin to dry rot.

It is I. P.'s function to constantly scan the technical horizon for those first faint clouds which betoken a change in the technological weather, and promptly to convey such data to its readers. This task could be enormously simplified by an alert and articulate craft acting in concert.

Bearing directly on this thesis is a suggestion from Merle Chamberlin, projection chief at the M-G-M studios. Merle proposes a new department in I. P. to be headed "Why Don't They?" which would serve to channel the ideas of the practical projectionist to the equipment manufacturers, and vice versa. Merle's idea on this score is that "once the gang got started on this track, our equipment and operating technique should progress by leaps and bounds." But the payoff line in the Chamberlin opus is a postscript stating: "Maybe this idea is sour, and if so, charge it off as just another wild pitch from Culver City."

That does it, there we have it. Right out of the Chamberlin subconscious popped the admission, however reluctantly, that projectionists as a craft are so apathetic and inarticulate as to constitute a definite threat to their own welfare. The sooner the craft drops this mask of false modesty or whatever it be that prevents it from spreading "wild pitches" all over the landscape, the sooner will there be positive assurance of present welfare and future progress.

Good sound projection is big-league stuff in the entertainment world now, and projectionists are on the Big Time. Individually and collectively they should conform to the standards imposed at that level. Ample evidence exists to show that the craft need look to no other industry group but its own for aid in building prestige. The job is ours—solely.

Amen.


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INTERNATIONAL PROJECTIONIST

VOLUME XXI MAY, 1946 NUMBER 5

Victor Animatophone 16-mm Projector

By *LEROY CHADBOURNE*

THIS article is designed to describe and illustrate the operation of the Victor Animatophone 16-mm visual and sound projector and to explain the basic principles of correct maintenance. These suggestions, it is hoped, will assist the projectionist in understanding the correct order of operating procedure.

The Animatophone is simple in design, construction and manipulation. Five basic steps should be observed in its operation and maintenance, as follows: 1, setting up equipment; 2, threading film; 3, operation; 4, speaker placement, and 5, maintenance.

1. *Setting Up.* The reel arms are removed from the case and placed in their sockets so that the shafts face the operator. Thereafter take-up belts are placed over reel arm pulleys, the nearest or inside belt going to the rear arm and the farthest or outside belt going to the front reel arm. Both belts must be crossed.

The belts are to be placed on the small pulleys for reels having small hubs such as the 400 reel, and on the large pulleys for reels having large hubs, such as those of 800 feet capacity and larger.

The female end of the power cord should be plugged onto the male connection at the rear of the projector. The speaker cord must be plugged into the keyed amplifier socket, likewise at the rear of the projector.

Threading Film. This operation can be quickly learned by following the simple instructions and threading diagram which accompany each equipment shipped out.

An automatic film trip is provided as a protection against film damage resulting from incorrect threading or previously damaged or torn sprocket holes. This device may be identified by the red rollers on the right side of the projector. In the event that any film loop draws up tight, or either film shoe is not closed or the gate not entirely closed, the red rollers are pulled forward. This kicks the operating lever out of position, stopping the film and cutting off the light before film damage can occur.

Operating Procedure. Referring to Figure 1, turn on the amplifier volume control (1), push down the exciter lamp switch (6), and set the tone control (2) at midway position. Next (see Fig. 2) set the speed control switch (13) for silent or sound film as desired and start projection by raising the operating lever (12) and pressing down the projection switch (8).

Should the projector mechanism automatically stop, this is indicative of an error in threading which may be traced down and corrected.

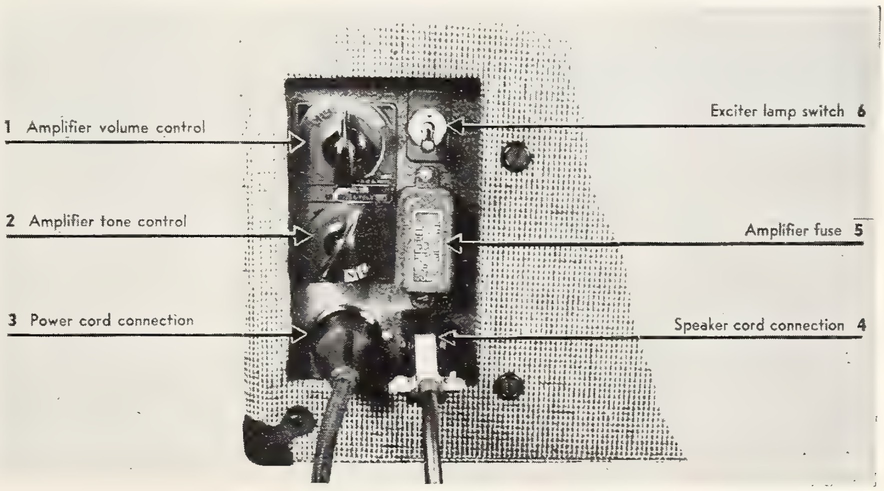
To sharply focus the picture the lens is revolved in its mount until the desired focus is obtained and is thereafter locked into position by turning down the lens lock screw (3). Framing the picture is accomplished by the framing screw (9) without altering the position on the screen, and the projector may be tilted by turning the knurled knob (21).

Pushing forward on the trip lever (2) stops the projector; while pushing down the rear tension roller (11) as far as it will go reverses the projector.

A single frame, or still picture, may be held on the screen indefinitely by pushing forward on the trip lever (20) and raising the still lever (6). Turning the shutter control knob (19) will bring any frame desired onto the screen.

Upon conclusion of the show an entire 1600-foot reel of film may be rewound

FIGURE 1



in less than a minute. The take-up belts are removed from both reel arms and the rewind belt is attached to the large rear reel arm pulley without crossing. Then, without removing the reels, the tail end of the film is inserted into the rear or empty reel and the rewind switch (7) is turned on.

Speaker Placement. Room acoustics are a determining factor in speaker placement. Walls and ceilings of plaster or other hard materials reflect up to 97 per cent of the sound waves and thus give rise to reverberation periods which renders difficult comfortable hearing. Curved or arched ceilings, also large ceiling beams, add to acoustical difficulties.

Under any of the foregoing conditions the use of several speakers is recommended to attain even sound distribution. Up to three speakers may be plugged into the original speaker with perfect matching of impedance assured.

These speakers should be placed at a central forward position as high as possible and fanned out. Also, they should be tilted downward to direct the sound into the audience area so as to reduce reverberation of sound waves striking the ceiling and rear wall.

Where walls or ceilings are of an absorbent material having an absorption factor of from 30 to 45 per cent, or more, a single speaker placed high and forward and toward one front corner of the room, and directed to the diagonal corner, will result in wholly satisfactory sound.

Maintenance. There are but seven places on the Victor equipment which require oiling, each of which is indicated by a red dot. These points should be oiled after approximately every four hours of running or after any prolonged period of non-use. However, only that oil supplied with the equipment should be used.

Cleanliness is of a course a prerequisite to a brilliant screen image, crisp sound and film safety. To clean the optical system remove the lamphouse by

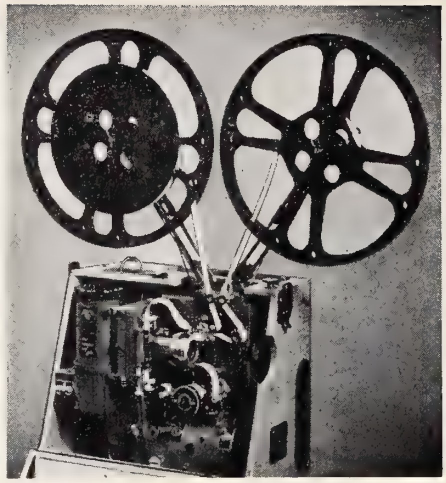


FIGURE 3

means of loosening the lock screw at the top and lifting off the housing. Thus the reflector and condenser are readily accessible for cleaning.

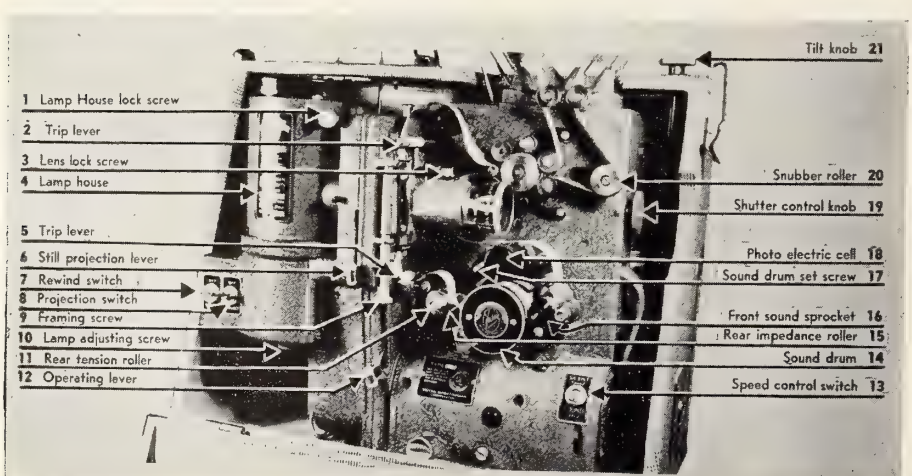
To clean the sound lens the sound drum is removed after the set screw is loosened. Thereafter the sound slit may be brushed out with a pipe cleaner; the bottom condensing lens may be cleaned in a similar manner.

All film travel surfaces are easily accessible for cleaning, the most important of which is the film gate which swings out to a 180-degree angle and thus may be instantly cleaned during the threading operation.

Replacements. Standard amplifier tubes are used having keyed bases and the tube sockets are numbered to correspond with the respective tubes. In Fig. 1 is shown the amplifier fuse (5) which may be replaced by removal of its metal cover held in place by two screws. The photocell may be lifted out following removal of its metal cover.

The exciter lamp is housed in the sound drum. It has a prefocused base requiring no setting and may be removed by depressing and turning slightly counter-clockwise. The pilot lamp has a

FIGURE 2



bayonet base and may be quickly removed and replaced after removal of its light shield.

The projection lamp is standard and may be instantly replaced following the simple removal of the lamphouse, as explained previously. The lamp may be aligned accurately on the optical axis for even screen illumination by loosening the knurled knob (10 in Fig. 2) on the base of the lamphouse and, with the lamp and projector turned on, so positioned until the screen is evenly illuminated.

All replacement parts, including the sound drum, are keyed into position so that their removal and replacement is simplicity itself.

Good showmanship is a requisite in 16-mm no less than in 35-mm projection. It comprises equipment in perfect operating condition, the projector set up in advance of the arrival of the audience, with the image centered on the screen and properly focused, and the speakers carefully positioned for the best sound distribution.

Magnetic Wire Recorder Now in Extensive Use

The wire recorder developed to a highly efficient state for use by the armed forces during the war, operates on the same magnetic principle as the earlier tape recorder, with the exception that a fine carbon or stainless steel wire of sufficient length to record continuously for an hour is used.

In these recorders the electrical impulses, coming from the microphone and strengthened in transit by an amplifier, constitute electrical current passing through an electromagnet. When a steel wire is passed through the changing magnetic field thus created, changes similar to the variations in the magnetic field are induced in the magnetic structure of the wire, i.e., the latter is magnetized to different degrees along its length, depending upon the original sound waves striking the microphone.

When played back, this wire, thus variably magnetized, is passed through a coil of wire called a solenoid, and the magnetic variations in the wire induce a weak, fluctuating current in the solenoid. This weak current is strengthened by an amplifier and may then be used to operate a loudspeaker.

The wire may be played back any number of times, removed from the machine and stored for an indefinite period, or reused simply by turning the switch on the recorder to "record." Thus, as a new recording is made on the wire, the previous recording is erased.

Eleven thousand feet of wire on a small spool allows the recording of programs up to an hour in length and is cited as a means of making reproduction more easily applicable to any situation. The extreme portability of the wire recorder permits its use in any part of the school plant and consequently considerable versatility in its possible applications.

The wire recorders currently on the market cost approximately $600 including a spool of wire and a microphone. The fidelity of the wire recorder is between approximately 200 and 5,000 cycles.

Elements of Projection Optics

II. Another article in a series anent the fundamentals of projection optics

By *DR. ANGELO MONTANI*
CONSULTING ENGINEER, NEW YORK CITY

THE terms "frequency" and "wave-length" recur so frequently in the technical literature that it is mandatory that we know their exact meanings. We have already seen how a vibrating membrane produces compressions and rarefactions in the neighboring mass of air, and we know that such disturbances travel in air at a speed of 1130 feet per second.[1] The distance of the distubance from the membrane depends, therefore, upon the time elapsed and increases with it.

If the membrane vibrates once every second, the first disturbance will be 1130 feet removed before the second disturbance is generated, and so on. If the membrane vibrates twice per second, the beginning of the first disturbance will be 1130 ÷ 2, or 565 feet distant before the second disturbance is generated, and so on.

The number of times the membrane vibrates every second is termed "frequency" and it is this factor which determines how spaced apart will be the disturbances travelling through the air. If a membrane has a frequency of ten, which means that it vibrates ten times every second, the travelling disturbances may be expressed as 1130 ÷ 10, or 113 feet apart. The distance at which the disturbances are spaced is termed "wave-length."

Thus it is seen that if we divide the *velocity* of the disturbance in feet per second by the *frequency* of the source of disturbance, the result obtained is the *wave-length* in feet. This may be expressed as follows:

Velocity ÷ Frequency = Wave-Length

The aforementioned fundamentals relative to air disturbances, pertaining to sound, also hold true for light, a disturbance produced by vibrating atoms. The velocity of light is enormous, but the fre-

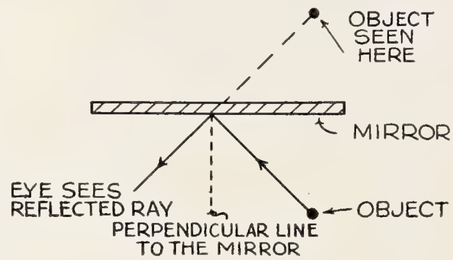


FIGURE 2

quency of the atoms is also extremely high, consequently the wave-length of light is very small and is measured in hundred-thousandths of an inch.

The difference in frequency of light appears to the eye as a difference in color. Red corresponds to the lowest visible frequency and to the longest wave-length; while violet possesses the highest visible frequency and the shortest wave-length. Between these limits range all the other colors. Following is the order in which colors are arranged as the wave-length diminishes: red, orange, yellow, green, blue, violet. When all these colors are mixed together in certain proportions they form so-called white light or daylight.

Propagation of Light

The propagation of light is rectilinear; in fact, we cannot see around a corner or through a coiled tube because light travels in straight lines. Thus the path of a beam of light is always represented on paper by straight lines or segments. The term "beam of light" is a simple geometric expression provided we remember that perpendicular disturbances are occurring along the beam (Fig. 1).

A classic experiment which demonstrates that light proceeds in straight lines is the pinhole test. One side of an opaque box is replaced by a piece of ground glass on the opposite side from which a pinhole is made. The faint image of exterior objects which is thus made to appear on the ground glass makes the box a rudimentary camera: in fact, by the substitution of a sensitive plate for the ground glass a picture would be obtained.

Seeing a ray of light we know immediately that its source is straight ahead. But if we are looking into a mirror, then the source is generally behind us (Fig. 2). The beam of light coming from its source and hitting a highly polished surface bounces back. Fig. 2 shows that the angle formed by the incoming ray and the perpendicular line to the mirror are equal to the angle formed by the outgoing ray and the same line. This is expressed thus: the angle of incidence of a ray is equal to the angle of reflection.

From the projectionist's viewpoint we must be mindful that a flat mirror introduces the "mirror-like distortion" in the image. Thus, if one holds a right-hand glove before a mirror, one will see therein the image of a left-hand glove.

Light travels in straight lines provided the space through which it travels remains of the same nature. If, however, glass or water or any other transparent body be located in the path of the beam, a sharp deviation in original direction will result. This phenomenon is known as "refraction."

Figure 3 shows how a beam of yellow light is bent by a slab of polished glass in its path. Because the surface of the glass acts as a weak reflector, not all the light passes into the glass, a small part of it being reflected back. With both polished surfaces of the glass being parallel, the beam of light comes out displaced, but upon emerging it resumes its original direction. If the beam of light should fall perpendicularly on the glass, no deviation or displacement whatsoever would ensue.

The same glass slab is represented in Fig. 4, but here the two surfaces are no longer parallel: they form an angle and the piece of glass is now a prism. In this section view the beam of yellow light is represented as passing through and being deviated toward the side of the base. If

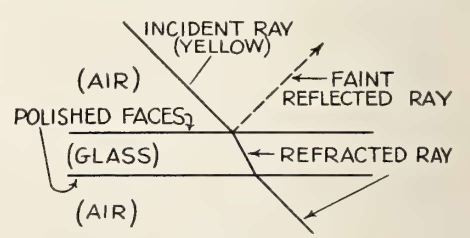


FIGURE 3

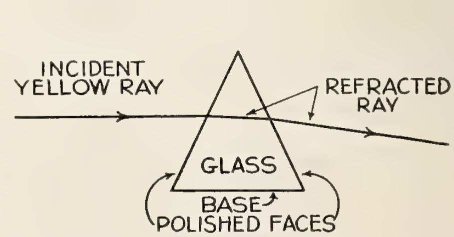


FIGURE 4

[1] "Elements of Optics," I. P. for March, 1946, p. 8.

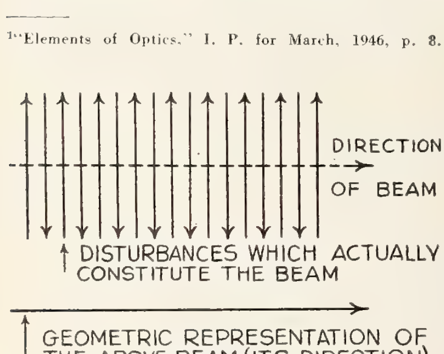


FIGURE 1

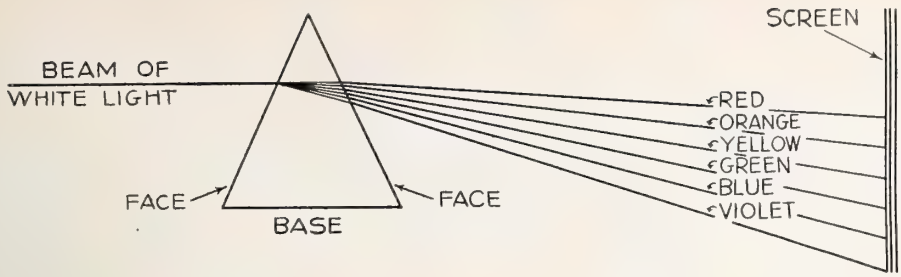


FIGURE 5

instead of using yellow light for this example of refraction (green, red, or blue would have served) we use a beam of white light, we observe a very interesting phenomenon, proved three centuries ago, that white light is composed of different colors.

Figure 5 represents a beam of white light entering a prism. The light splits into different colors inside the prism, and the constituent colored beams emerge ever more spread apart. We see on the screen all the colors which make up the white light. Note that red is the color least deviated; violet the most.

A prism is said to "disperse" colors. It is an optical element which does not, however, deviate all colors to the same degree.

To summarize the data adduced thus far: light travels in straight lines until it encounters a reflecting surface (a mirror) which bounces it back. Light may encounter transparent bodies of varying nature (glass, water, etc.) which alter its path and give rise to "refraction."

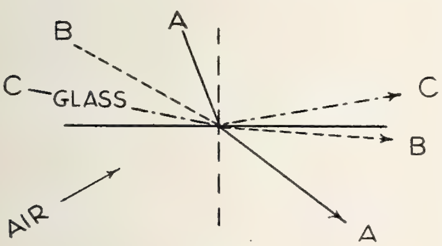


FIGURE 7

The transparent media do not bend all colors to the same extent, therefore the light entering therein will be split up into its elementary colors.

We consider now the "refractive power" of transparent bodies. Fig. 6 shows three different transparent bodies: water, light glass, also called "crown," and heavy glass or "flint." A ray of yellow light entering each of these bodies at the same angle with the surface results in the beam deviating differently in each medium. We see that the ray is bent most in the heavy glass, the most dense of the three bodies.

The diagram illustrates how a beam going from a less dense medium, like air, to a more dense medium, like water or glass, is bent, coming near the perpendicular to the refracting surface.

The opposite happens, of course, when a beam from a dense medium encounters a less dense medium. Fig. 7 shows how not all the beams of light entering a slab of glass have a chance to leave the glass. We see how ray *a* and ray *b* leave the glass, while ray *c* is reflected back inside the glass itself. Ray *c* is bent so much that it *must* come back.

The refractive power, or "index," of optical glass is usually employed to identify the type. This power is expressed by numbers generally lying between 1.50 to 1.75. Fig. 8 shows at a glance how these

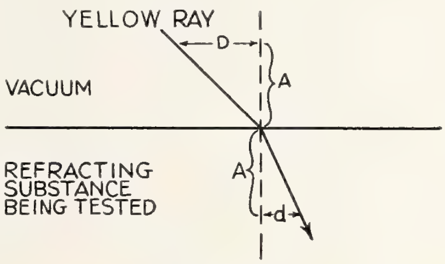


FIGURE 8

numbers are obtained: it is the quotient of the division of *D* by *d*. The smaller the value of *d* the higher is the quotient number and the higher the corresponding refracting power, or index, of the glass.

An application of this principle is illustrated in Fig. 9 where there is shown a right-angle prism, one of the most useful and widely used optical elements. The light entering one face is reflected by the base and emerges through the second face. If the light be white, no decomposition or dispersion occurs, as it does in the example cited in Fig. 5. In fact, the white light is decomposed into its elementary colors upon entering the first face and then is recomposed upon exiting at the second face. This prism performs like but is superior to a mirror because there is no absorption of light at the reflecting surface. In fact, the light is reflected by the base because, since the rays behave like ray *c* in Fig. 7, it has no other place to go.

The most simple exposition of why a lens can converge or diverge a beam of rays is to assimilate the lens to a couple of prisms joined together by the base or by the vertex. Fig. 10 (a) shows the similarity between the section of a convex lens and the section of two prisms with a common base. This type of lens is called

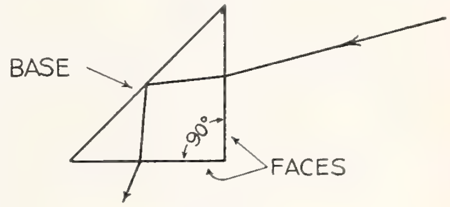


FIGURE 9

"convergent" or "positive" because it forms convergent beams of rays and produces real images of the objects.

In Fig. 10 (b) is shown the analogy between a divergent lens and two prisms joined by the vertex. This lens is called a "negative" type and does not form real images which can be projected onto a surface. Upon looking through this type of lens an object appears reduced in size, the image being termed a "virtual image."

A very important reference element of the lens is the "optical axis" which crosses perpendicularly through the center of the lens in such a way that every portion of the lens is symmetrically positioned. For the sake of simple exposition, lenses are

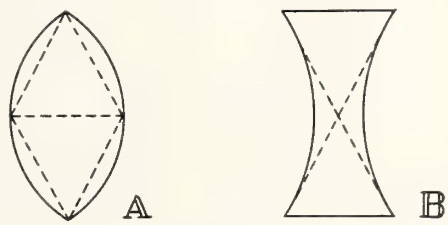
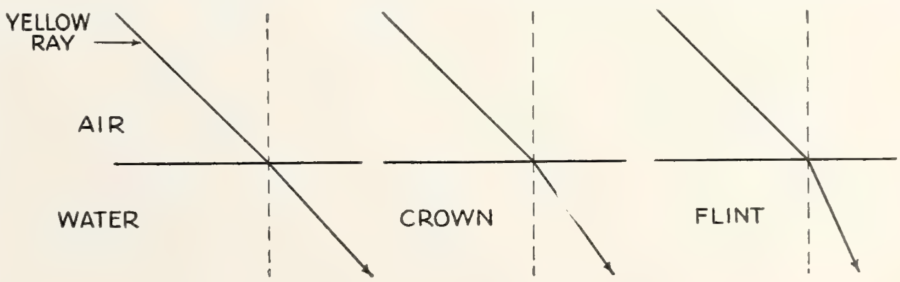


FIGURE 10

generally represented in diagrams according to their section, with the optical axis lying in the plane of the drawn or printed surface.

The surfaces limiting a lens are, except in rare instances, spherical; and since a sphere is identified by its radius, the curvature of the lens surfaces are related to a radius. Thus, the longer the radius the

FIGURE 6



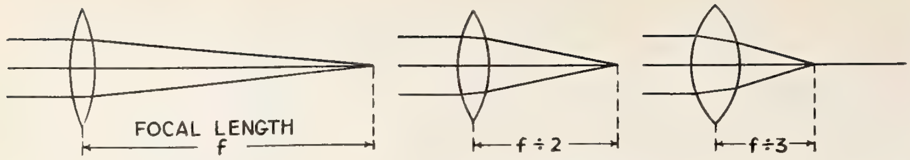


FIGURE 11

less curved is the surface of a lens.

When a beam of rays of one color located near the optical axis and parallel to it enter a convergent lens, the rays meet at a certain point located behind the lens. This point is called the "focus" of the lens. Assuming the thickness of the lens to be insignificant in comparison with the distance between the lens and the focus, the latter distance is termed the "focal length" and is reckoned in inches or in centimeters.

Lens Power Calculation

Figure 11 shows three lenses all constructed of the same glass but having, from left to right, increasing curved surfaces. The third lens has a focal length one-third that of the first lens and is three times as "powerful." The second lens has a focal length one-half that of the first lens and is twice as "powerful." If all three lenses were made out of heavier glass, while retaining the same curves, their respective focal lengths would shorten, although they would retain the same relative values to each other.

The power of a lens is determined, therefore, by both the curvature and the refractive index of the glass.

The opposite phenomenon is shown in Fig. 12. Here a parallel beam of light enters a divergent lens. The rays diverge without forming a real focus, but by extending the direction of the divergent rays

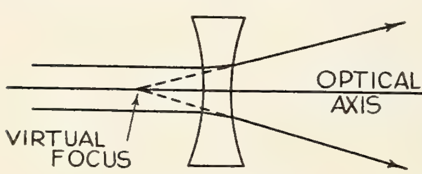


FIGURE 12

a virtual point is located on the optical axis which is called the "virtual focus." The distance between this point and the lens is also the focal length of the negative lens.

The reason why a negative lens is employed in objectives and in lens systems is because it possesses all the errors of a positive lens but in a contrary sense. By using this lens it is possible to correct or attenuate the errors in lens combinations employing both types of lenses.

The combination of a positive and a negative lens almost in contact with each other results in a positive compound system having a longer focal length—that is, provided the focal length of the negative lens is longer than that of the positive (Fig. 13).

Lens correction is an intriguing topic and we will try to sketch the basis for the "achromatic" correction of lenses. Fig. 14 (A) shows how a positive lens disperses the white light into its constituent colors. The extreme focii of the violet and the red are shown. The negative lens, in the middle portion of section A, also disperses the white light to the same

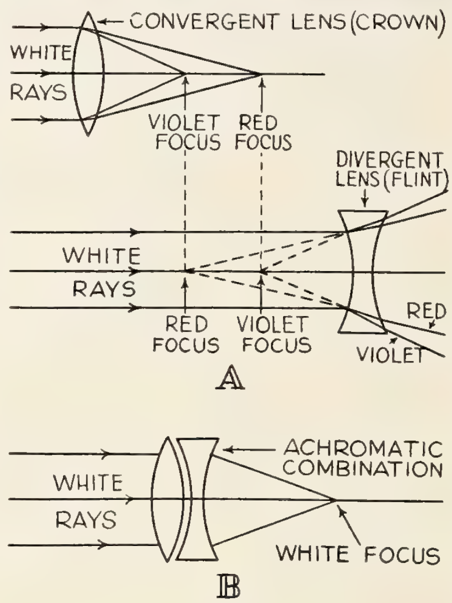


FIGURE 14

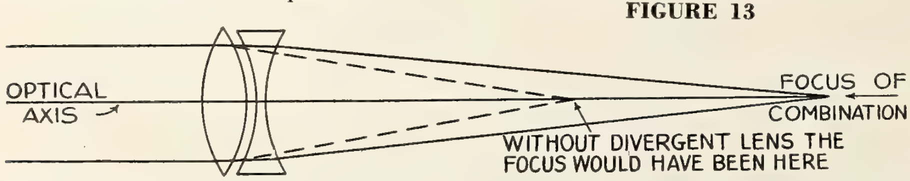
degree but in the opposite sense; moreover, its average focal length is longer than that of the top lens. Therefore by combining both lenses (shown in section B) we obtain a compound lens with positive focal length with practically one focus for all colors. Such a lens system is termed an "achromatic" one, that is, without color errors.

Every projection lens must be achromatic, otherwise the images would appear on the screen fogged and showing coloration at the borders. Also, the achromatic correction diminishes other lens errors, a topic to be discussed in subsequent articles.

True, tolerable projection can be attained by using simple lenses, but this is accomplished by sacrificing flatness of field, wasting much light, and tolerating a low-intensity projected image. Simple lenses are employed only in inexpensive amateur projectors.

The *f* number or *f* ratio, as every projectionist knows, determines the luminosity of the objective. The focal length of the lens, in inches or centimeters, divided by the physical diameter of that portion of the lens actually used determines the *f* number. If the lens be a simple one, its focal length divided by the lens diameter gives the *f* number.

FIGURE 13



Good Splice Technique

Various articles in I. P. on the making of good splices were very interesting especially the suggestion submitted by Norman Hill. I tried Norm's method where he clips the corners off both sides of the splice and found it to be very good indeed; but I have dropped the practice as it required too much time. Very few such splices come through, so I guess it is not used extensively.

I have finally devised a method which is very simple and which gives very satisfactory results. Any competent projectionist will quickly recognize a poorly cemented splice; 90% of such splices appear to have no cement at the extreme outer edges and especially all four corners, manifested by a whitish or "dry look" on the splice about 1/8 inch in on one or both sides.

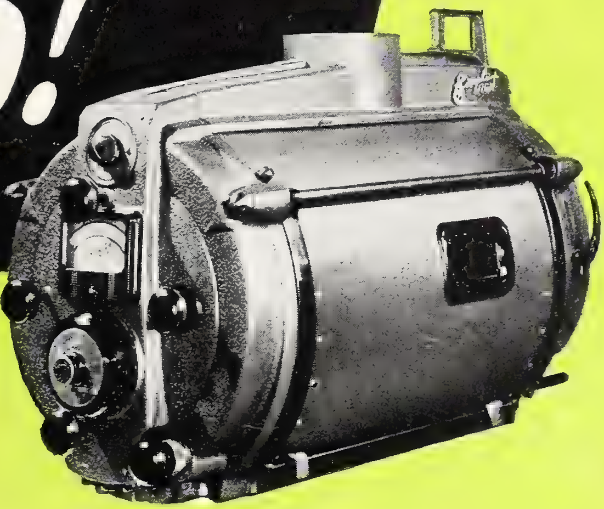
My method varies only in the cementing of the splice. Instead of placing the brush full of cement on the far side of the splice and drawing it toward me, thereby letting the cement flow on and also depriving one end from as much cement as the other, I proceed as follows:

Edges Completely Covered

Taking the brush full of cement I touch it to each side first. This assures plenty of cement where most needed—at the outer edges near the sprocket holes where the drag of the film comes. I then give the brush a half turn and fill in the center space, insuring a completely cemented surface on this part of the splice. Then I draw the brush across the underside of the film which is in the right-hand side of the splicer. As there is very little cement left in the brush after cementing the left-hand area, there will just be enough to nicely soften the r-h area: bringing the two sides together then with the clamp makes a very strong splice as they seem to "melt" together as *both* sides were dissolved on the surface and not only one as in the conventional method.

It is not necessary to leave the splice in the splicer for more than a very few seconds. Rubbing the splice between the thumb and finger will show cement to be over even the smallest tip, making a very strong and lasting splice. Defective splices are a chief worry of subsequent-run projectionists; and my method aims to help these fellows.—ARTHUR SWEET, *L. U. 528, Kingston, Ont., Canada.*

This is the lamp!



● This is the lamp that put doubly brilliant high intensity projection lighting within reach of all theatres.

● This is the lamp that delivers the snow-white light necessary to the satisfactory projection of Technicolor pictures.

Simplex HIGH

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"THERE'S A BRANCH NEAR YOU"

SMPE 59th Technical Meeting

Held at the Hotel Pennsylvania, New York City, May 6-10

MARKED by the resumption of all pre-war functions, the 59th semi-annual Technical Conference of the Society of Motion Picture Engineers proved tops in every respect, including total registration, number and variety of papers and demonstrations, outside group visits to television studios, and, last but certainly not least, social activities.

Attending the Conference were representatives of every branch of the motion picture industry—from cameramen to theatremen, and all other crafts which link up the chain—while the close affinity of the film world with the electronic arts was emphasized by the presence in strength of members of the radio broadcasting and television fields.

The projection field was represented handsomely by a phalanx of equipment manufacturers, projection supervisors of many studios and theatre chains, Local Union officials, and a drove of men from the theatre firing line, projectionist Joes who, naturally, were present on their own time and expense.

Fortuitously, three other related industry groups held convention sessions in New York concurrently with the SMPE, thus providing a unique opportunity for the engineers to expand their activities and interests. These organizations were the Acoustical Society of America, the 16-mm Industry Trade Show, and the Inter-Society Color Council, the latter group participating with the SMPE in two joint lecture-demonstrations.

Color, Video, Labs Featured

Color, studio and laboratory techniques, and television were the featured topics throughout the Conference. Video enthusiasts were afforded a rare treat when on successive days group visits were made to both the RCA-NBC television studios in Radio City and to the DuMont John Wanamaker studios in downtown New York, the latter facilities having been just recently completed and embarked on a regular broadcasting schedule. Rather conspicuously absent from the program was any provision for viewing Columbia Broadcasting System's process for color television, the topic recently of some rather tart exchanges of viewpoint in the television field.

Of outstanding interesting was the session devoted to an extensive summary of and report on the Agfa Color Film Process by a technical mission, which, representing the U. S. Dept. of Commerce, has only recently returned from an extended trip to Germany where it conducted an exhaustive investigation of this much publicized process. This session was presided over as chairman by Nat Golden, chief of the motion picture section, U. S. Dept. of Commerce, and a longtime member of Cleveland Local 160.

So much sought after is this Agfa color process, following the mission's report on the succeess attained with it by the Germans, that the U. S. Dept. of Justice intends to press for special legislation governing its disposal as the only equitable solution.

Thomas Armat Honored

A highlight of the Conference was the presentation of a citation and scroll to Thomas Armat, who invented and personally operated the film projector used at the first public showing of motion pictures at Koster & Bial's Music Hall, N. Y. City, on April 23, 1896. Armat subsequently invented an improved projection method which was adopted by Edison, Powers, Vitagraph, Lubin, Baird, Simplex and other projector manufacturers.

Also honored was Warner Brothers, Inc., which was presented with a citation and scroll commemorating the 20th anniversary of sound pictures. In accepting the citation, Major Albert Warner paid high tribute to the industry's technical forces and predicted that the engineers would provide motion pictures with even greater appeal in the near future.

Echoing Major Warner's prediction was a most interesting paper by Jack Norling on the control of light by polarization. The Loucks & Norling studio, producers of pseudo-stereoscopic motion pictures (requiring the use of analyzers) has never relaxed its research and experiment anent the requisites for a true three-dimensional film.

Of particular interest to the projectionist craft was a report by the Committee on Motion Picture Education, read by chairman Dr. John G. Frayne. This report details the extent of motion picture technical education in the U. S. colleges and urges its rapid expansion. Dr. Frayne endorsed a comprehensive training program for all film technicians and suggested soliciting the active interest and cooperation of the labor unions in behalf of such a program.

It is likely that a special committee which will concern itself with attaining this goal will be named in the near future, and the appointment thereto of several Labor representatives is assured.

Appended hereto are excerpts from a representative group of papers presented at the Conference:

FILM TECHNICAL PROBLEMS OF NAVY'S SPECIAL TRAINING DEVICES

By *H. S. Monroe*

Film production for the Navy's Special Training Devices involved a large number of special problems peculiar to this work, in addition to all the usual problems of film production. The paper will discuss these special problems, which were caused by the urgency of war, the conditions under which the films were used, the necessity for maximum realism, and the need to provide for assessing the student's work.

LIGHT SOURCES AND COLORED OBJECTS

By *R. M. Evans*
Eastman Kodak Company

This is a general survey of the relationships which exist between the energy distribution of the light source, the absorption distribution of colored objects, and the color which the eye sees as the result. The general problem of subtractive mixture is first discussed in a semi-technical manner, after pointing out the necessity for understanding and using spectrophotometric curves. Color photographs of the phenomena were shown.

Several special cases of subtractive mixture are considered, with special emphasis being placed on objects which match under one

(*Continued on page* 30)

Film Standards Committee to U. S., Bids the S.M.P.E.

The S. M. P. E. is making a strong bid to have the newly proposed international standards organization locate the secretary of its motion picture committee in this country "because of American leadership in the field of motion picture engineering standards." The motion picture section of the pre-war International Standards Association was located in Germany.

The S. M. P. E. feels that because of superior equipment the American film industry should take first place in international standardization.

Because American industry on the whole failed to participate in international standards work before the war, the S. M. P. E. said, much American equipment was barred from sale abroad due to different standardization there.

Bucky System of Multiple-Speaker† 'Live' Sound Reproduction

By *PETER A. BUCKY*

Our physical senses are incapable of absolute measurement but indicate by comparison only. Their reaction to harmonious sounds is an emotional experience not measurable by ordinary means. Conventional theatre loudspeakers do not reproduce the emotional effect created by a "live" orchestra, thus these highly directional systems should be replaced with a multiple-speaker system having nondirectional characteristics in which reverberation enhances the original sound.

MEASURING methods are the means of comparison and standardization. They enable any person to duplicate certain findings concerning matter or energy. Psychological perception of matter and energy takes place by means of sense organs which, however, are confined to touch (consistency, shape, surface, location), warmth, light, sound, and smell.

We have no organ of perception for other energies such as, for instance, certain electromagnetic waves. Calibration of such energies can only be accomplished by converting them into other forms of energy for which we are equipped with a specific sense organ. The brain does not perceive any physical energy directly, but transformation into electro-chemical action is necessary, which is then conducted by the nerves to the brain. This transformation takes place in our sense organs.

Furthermore, these sense receptors are not able to differentiate exactly qualitative or quantitative perceptions. There are only a few persons who, for instance, have "absolute pitch," meaning they are able to recognize correctly the frequency of the sound wave to which they are subjected.

Basis for Comparison

We certainly can differentiate colors, but only by comparison. A white paper in a dark room illuminated by red light reflects red light only; but after some time we fail to perceive the color as such. We are able to differentiate the light intensities of various objects. We cannot differentiate the various components of white light, but we can generally recognize the individual frequencies of sound in an orchestra. The judgment of quantity is still more difficult. At night we might be blinded by a match; whereas in daylight the same match does not interfere with our vision.

This proves that we have no means to define by our perception the absolute energy and quality of light and sound. We can only compare qualities and quantities with relation to each other.

Transformations of energy do not follow straight-line curves, and these curves are by no means identical in type to the different methods of transformation. In physics we can coordinate the different curves according to some absolute measuring system. But when it comes to psychological perception, the problem of measuring sensations becomes highly complex if not hopeless.

These considerations lead to the conclusion that our physical make-up gives us rather limited means of analyzing psychological perception. The matter becomes still more complex in the reproduction of music *as an entity* as contrasted with a mixed aggregation of physical frequencies. Music as an art impresses the listener with emotional resonance. It can be safely stated that the psychological response is the most important part of the entire problem of sound perception.

Artistic impressions are highly individual. Therefore, a statistical average can be the only solution. As much as physical measurements might be of help, our attempts should not be dominated by them. Close cooperation of musicians, physicists, and psychologists is imperative, even more so than it was in the past.

I do not pretend to assume that these deductions are novel; in fact, they are obvious. However, our investigations supported these assumptions. Since the physical fundamentals have been so well established by physicists and engineers, the way is now clear for musicians and psychologists.

The directional effect allows the listener to locate the source of sound waves. There cannot be any doubt that the artistic impression of orchestral music in general does not depend on the directional effect. On the contrary, nondirectional perception of sound is ideal and will produce a harmonious and mellow quality.

Non-Directional Sound Ideal

The directional effect must be comparatively greater when the sound waves travel directly from the source to the ear of the listener without reflections or reverberations. That means that in an enclosed space the directional effect will be less noticeable. Illusion is interfered with if the directional sound comes from a different direction than light impressions. Therefore, loudspeakers in theaters are usually placed near the screen.

According to our experiments, nondirectional—meaning evenly distributed sound—does not interfere with illusion. The instruments in an orchestra, especially the wind instruments, are seated in a linear order to dampen the directional effect, indicating that an overemphasized directional effect is not desirable.

There is a great difference between the individual instruments. Brass instruments, for instance, are built to project the sound waves in a beam; whereas the majority of the other instruments produce unfocused spherically progressing sound waves. The sound of wind instruments is mainly reflected by the vertical walls; whereas the ceiling plays the

(Continued on page 26)

† J. Soc. Mot. Pict. Eng., January, 1946.

MODERN QUARTERS REFLECT STRONG ELECTRIC CORP. EXPANSION

A total of 47,000 square feet is now required to house the extensive manufacturing program of the Strong Electric Corp., of Toledo. Twenty years' steady progress in the manufacture of projection arc lamps, rectifiers and reflectors has seen a fifty-fold expansion in floor space and a hundred-fold increase in employees.

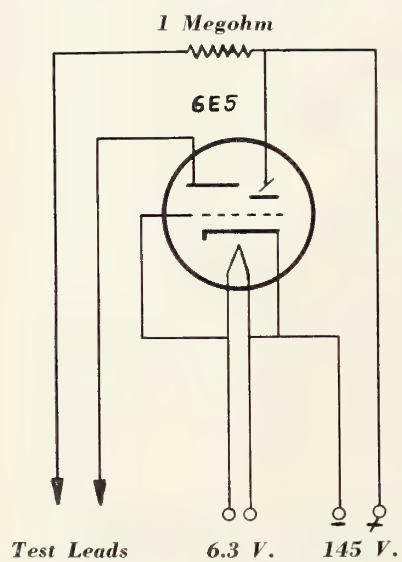
iP AT YOUR SERVICE

This department is devoted to the man behind the man behind the gun—the serviceman. Its prime purpose is to promote a closer relationship between projectionist and serviceman based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. Contributions from both groups are invited.

SOME potentiometer shafts used in conjunction with sound equipment have been found to work loose within the potentiometer itself. This is due in many cases to the leverage that can be obtained with the fader knob. An excellent corrective for this condition is to drill a hole in the side of the dial in the proper place to insert a pin that will strike the mounting bracket when turned to "O" point.—T. M. Cambell, *RCA.*

Inexpensive Capacitor Checker

An inexpensive capacitor checker using a 6E5 Radiotron can be usually made up to check intermittent operation or capacitor leakage by connecting up a 6E5 tube as shown in the accompanying



sketch. The power supply may be obtained from batteries or any other power source to provide 6 3/10 volts for the filament and 145 volts for the B+. If the condenser is intermittent or is leaky, the 6E5 tube shadow will flicker. Condensers having good insulation will not change the shadow movement.—R. H. Hecht, *RCA.*

Replacing Power Transformer in MI-1228 Amplifier

When replacing a power transformer in the MI-1228 monitor amplifier, try reversing the leads from the front of the amplifier to the rear. This will not crowd the wires into a confining space. Twist each pair and leave them long so that they will lie down low inside of the cabinet where there is a minimum of heat.—RCA Engineering Dept.

Loss of Amplifier Gain

Loss of "apparent" amplifier gain in various systems can often be traced to the volume control unit. Some of these controls, after months of operation, may test between 250,000/350,000 ohms for a rated 500,000 ohm value. Replacement is necessary.—R. H. Bisbee, *RCA.*

Lifting Reel Alarm Roller

A simple system of lifting the reel alarm roller arm when the magazine door is opened can be made by using a piece of rawhide lacing or a string fastened under the top screw of the operating side door hinge and carried over the top of the hinge around the magazine. A hole in the other end allows the clapper arm to slip through it. By experimenting to obtain correct length of rawhide it will be found that operation is quite satisfactory.—C. D. Welch, *RCA.*

Emergency Arc Feed

In an emergency, when arc feed relay contacts have gone bad, hook a lamp socket across the contacts and insert a 110-volt bulb. Start out with a 60-watt lamp. If the speed is too fast or too slow, try a different size bulb. Usually, after an hour's operation, a 40- or a 50-watt lamp will run the motor just about the right speed. This is much more convenient than feeding by hand. —R. H. Hecht, *RCA.*

Correcting Fluctuating Gain in Simplex 1001 Power Amplifier

Fluctuating gain in the Simplex 1001 power amplifier can usually be traced to the feedback circuit. Capacitors C7 and C8 in the low frequency end adjustment part of this circuit have been known to cause intermittent operation.

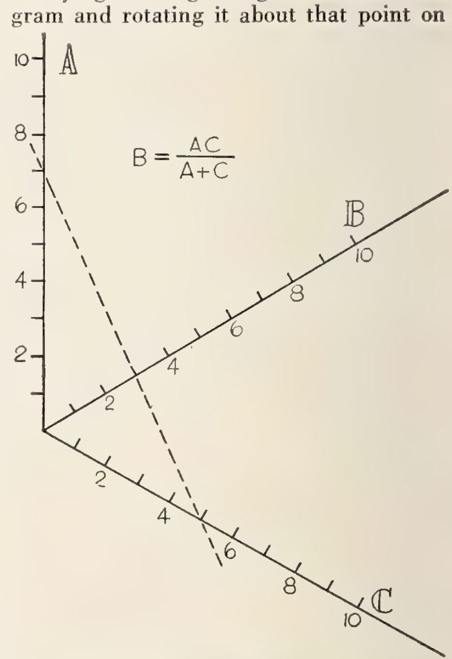
In systems using more than one power amplifier, contacts in the 2013 switch assembly are used to close the circuits between 3 and 4 in the RVC circuit. Corroded contacts at this point will cause the feedback to vary and hence the gain to fluctuate over a wide range. Replacement of the feedback control P1 can be made by using any good wire wound control of 2000 ohms having a log taper.

Resistor R21 should be moved when the 2000-ohm control is used, and the adjustable stop, usually furnished with controls of this type, set to limit the rotational adjustment of the control in such a way that approximately 280 ohms are in the circuit when the feedback control is set for maximum gain.—C. C. Nagel, *RCA.*

Simple Resistor Computer

Here is a simple parallel resistor/series condenser computer which can be drawn to a scale to fit your own particular pocket notebook or can be constructed on the job in a couple of minutes. It has been found quite handy, and a time saver, in computing parallel resistance combinations to replace a single defective resistor, when a replacement of the approximate correct value is not available.

Laying a straight edge across the diagram and rotating it about that point on



the "B" scale corresponding to the value desired, the various parallel resistor combinations which will give that value are indicated on the "A" and "C" scales. The angle between each pair of scale lines is 60 degrees, and the scale may be in any units, provided they are uniform and equal on all three scales.—E. G. Hemenway, *Altec.*

Emergency Repair of Centrifugal Switch

An excellent substitute spring can be made from a discarded 22886 film tension shoe. With a pair of scissors or tin snips, cut the spring to the required length and then cut a small "v" in either end. This emergency substitute can be used until such time as a new spring is obtained.—Nelson Spock, *RCA.*

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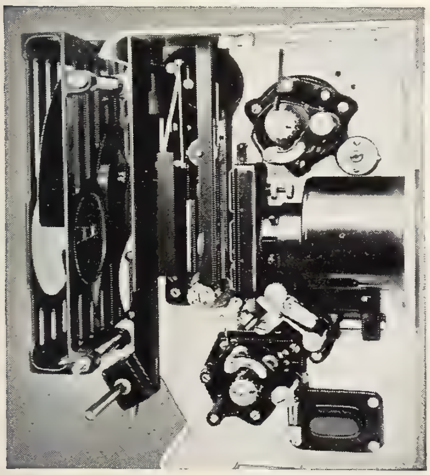
Every exhibitor can profit by the dependable performance, easier handling, and longer life of the new Brenkert Projector (Type BX-80). Its many exclusive features . . . tooled with watchpart accuracy . . . represent three decades of research—make it the one-and-only projector for the *modern* theatre.

SIMPLICITY OF OPERATION

EVERY precision-detail of this projector was engineered to simplify operation and provide virtually trouble-free operation.

Exclusive *self-lubricating* system needs little attention—oils entire mechanism properly and continuously *from within.* No oil can be thrown on lens or film to impair the quality of the picture.



Brenkert Projector showing film side with oil-proof and dust-proof features and aperture cooling.

Pre-set microscopic focusing allows removal and replacement of lens *without changing focus.*

All parts are easily removable for quick cleaning and servicing.

Air—silently drawn up through the film trap—automatically cools the picture aperture—and is *vented at top* of projector. Air in lamphouse remains undisturbed, arc not affected.

The secondary aperture for framing enables operator to thread film accurately and quickly.

Adjustable tension on the film gate is provided for the proper projection of all types of film.

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THEATRE EQUIPMENT

RCA

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

IN THE SPOTLIGHT

By *HARRY SHERMAN*

THE right to strike is labor's only real weapon against economic slavery. While we do not advocate strikes, being of the opinion that all strikes could be eliminated if negotiations were properly handled, we do say that labor's right to strike must remain inviolate. To lose that right would mean the end of all that organized labor has fought for, and would in a short time spell the doom of labor's last weapon against industrial tyranny.

Recently, in the House of Representatives, one of its members recommended on the floor of the House that the right to strike be suspended for one year. This recommendation was bitterly opposed by Rep. Frank E. Hook, of Michigan, who defended labor's right to strike and assailed those members who translate our Constitution in terms of protection for their own personal rights and advocate a different conception where labor is involved.

"If the right to strike is denied the laboring people of this nation," said Rep. Hook in addressing the House, "they are forced into involuntary servitude in violation of the principles laid down by the Constitution of the United States. . . . When the voice of the laboring people of this nation is stilled by edict of government, fascism will have been established supreme in this country and the millions of lives and the sacrifices made in the last war will have been in vain.

"It has become rather popular of late for certain individuals and groups of individuals to malign labor and labor unions. If these people would give serious study to the problem of labor and management, they will agree with me that voluntary arbitration—free, open, and honest collective bargaining—is the heart of democracy."

● Charles Barekman, business manager for Local No. 421, Herrin, Ill., has been elected a delegate to the I. A. Convention.

● A recent demonstration of the Brenkert projector at RCA's Los Angeles headquarters was attended by many members from Los Angeles Local No. 150 and Hollywood Local No. 165. This demonstration, sponsored by the John P. Filbert Supply Co., featured a talk by H. J. Benham, Brenkert factory representative, on the special features of the Brenkert arc lamp and projector. Later in the evening Benham took apart the projector mechanism, explaining in detail the features of each unit.

In speaking of the demonstration, Al Malley, member of Local 150, said, "Meetings of this nature are a real pleasure and serve a useful purpose; may there be more of them." We agree with Malley and we suggest that it would be to the advantage of all manufacturers to sponsor throughout the country such practical demonstrations of their projection room equipment for the benefit of the ultimate users of their products—the projectionists. This would not only enable the projectionist to gain a better understanding of the care and maintenance of a given mechanism, but would help the manufacturer to properly present the special features of his product.

● Congratulations to Ed O'Connell, former business agent for Local No. 74, New Haven, Conn., on his 52nd year in show business. O'Connell is employed at the Commodore Hull Theatre and, despite his many years of shifting scenery backstage, is just as active and spry as a man half his age.

● Walter R. McCormick, C. W. (Pat) Offer, James J. Eddy, and Wm. Reynolds, were elected delegates to the I. A. Convention to represent Hollywood Local No. 165.

● Bert Ryde and Owen Kavanagh, business agent and secretary, respectively, of Buffalo Local No. 233, were among the out-of-town visitors to the offices of I. P. last month. Ryde presided at the installation of the recently elected officers of the Buffalo Film Exchange Office Employes, Local F9, doing his usual efficient job.

● Harry J. Abbott, Abbott Oliver, Horace Johns, and Ben Green, of Philadelphia Local No. 307, were elected delegates to the forthcoming I. A. Convention.

● Evidently the present attorney-general of Massachusetts doesn't rate very high with labor in that state for we learned

I.A. MEN VIEW TELEFILM RACE SHOTS AT SANTA ANITA

Telefilm's 16-mm movies of every horse race and then shown on a screen a few minutes after race is over are viewed by I.A. technicians. Front row: Frank Titus, Len Gloyle, Elmer Dyer and John Stevens, Jr. Second row: Frank Blackwell, Al Wetzel, Roy M. Brewer, I.A. representative, and George Schaffer, Local Union 150 B. A. In rear are projectionists W. A. Cook, and, framed by projection room port, John J. Hill.

that Benjamin Hull, member of Springfield Local No. 186, and vice-president of the State Federation of Labor, has called upon the Republican State Committee to endorse State Representative John W. Vaughan for nomination for the office of attorney-general.

● Recent items appearing in these columns anent sanitary conditions prevailing in theatre projection rooms throughout the country have stirred up considerable interest in union circles. In many cities—not even excepting large cities like New York, Chicago, Detroit, San Francisco, etc.—the projection rooms of most theatres are no better than stuffy pestholes, with little or no ventilation and no sanitary facilities.

In Chicago, however, this situation has been corrected, thanks to the determination of Gene Atkinson, business manager of Local No. 110, to remedy these conditions. Now all Local 110 contracts include provisions for the installation of sanitary facilities and for proper ventilation in all projection rooms in its jurisdiction. Theatre owners are given the choice of either making the aforementioned installations, or stopping the shows at stated intervals each shift so as to give the projectionists rest periods. Needless to say, the former condition is preferred by most exhibitors.

Gene Atkinson

Detroit Local No. 199 has taken similar steps to protect the welfare of its members, and through its president, Frank Kinsora, has served notice upon theatre owners to correct unsanitary projection room conditions wherever they exist (I. P., March 1946). We believe that the theatre owners will cooperate with the local in this respect, and expect to hear shortly that the Detroit projection rooms are operating under improved conditions.

Recently in New York, Joseph Kimmel, member of Local No. 306, showed us a petition with over 1,000 signatures which will be presented to the Commissioner of Sanitation demanding that immediate action be taken to force theatre owners in this city—owners of small neighborhood theatres as well as of de-luxe Broadway houses—to install proper sanitation and ventilation in their projection rooms. We think Kimmel should have the cooperation of the entire local for this worthy cause as it affects the health and well-being of all members.

● Recognizing the potentialities of the 16-mm field, Los Angeles Local No. 150 has appointed Sidney Burton as business agent in charge of 16-mm activities. Sid is in complete charge of organizing this field, which is rapidly expanding and looms as a new postwar industry to be reckoned with. Burton has always taken more than a passing interest in new developments in this field, and we know that his present assignment is another tough nut to crack; but crack it he will.

● Guess married life holds no terror for our good friend, Allen J. Smith, of National-Simplex-Bludworth, who recently took unto himself a wife, Elizabeth Dougherty of Kansas City. Having met the new Mrs. Smith, we can understand why Allen joined the ranks of benedicts.

● The newly elected officers of Philadelphia Local No. 307 have had their first crack at demonstrating their skill as bargainers. Their first wage scale negotiations resulted in new contracts calling for a $5 per week increase for each member; overtime pay increased an additional 25c per hour; time-and-one-half pay from midnight to 8 a. m. (an innovation for Local 307); vacations with pay, and $7.50 per week increase for those members working the all-night houses (4 in Philly). All increases are retroactive to January 1, 1946.

Our congratulations to the negotiating committee, namely Harry J. Abbott, Horace Johns, Abbott Oliver, Abe Freeman, Ben Green, and Charles Humphries.

● A letter from Edward Riley, member of New York Local 306, who was seriously injured several years ago in escaping from a fire in his projection room, reveals some interesting sidelights on the aftermath of that harrowing experience. The fire broke out in the rewind room, which was nothing more than a small cubby-hole next to the projection room, with no outside ventilation except a tiny opening in the ceiling leading to the roof of the building. The flames quickly spread to the projection room. When Riley tried to make his escape by means of a ladder which led to the only door through which one could enter or leave the room, his path was blocked by the fire. In order to prevent being burned to death Riley jumped from a small window in the rear of the projection room and landed on a rubbish heap three stories below, sustaining injuries which later necessitated the amputation of one of his legs.

After being hospitalized for the past two years, Ed is now home and is learning to walk with the aid of an artificial limb.

In his letter he mentions a visit he paid to the theatre where he had been working at the time of his accident and tells of a conversation he had with the owner "While I was talking with the owner," writes Ed, "he said that he had often warned the projection crew to keep a *r-o-p-e* handy to use in an emergency. In other words, he knew that a man could be trapped in the booth, necessitating an escape from the window, but he thought a rope would be adequate. This very window created a draft which whipped the flames around the room toward the window."

A new rewind room with a second door was built *after* the fire; but a man had to suffer untold agony and become a cripple for life before any steps were taken to prevent such an occurrence. For shame!

MOVIE PREMIERE ON GIANT PAN-AMERICAN TRANS-OCEAN PLANE

View of interior of 54-passenger, ocean-hopping plane on New York-Paris run as initial showing of feature film "So Goes My Love" was accomplished by means of special 16-mm sound projection equipment built by Bell & Howell Co. Photo indicates that the viewing angle is an urgent problem in restricted plane space. Speaker outlets are flushed with ceiling. Movies have long been commonplace events on domestic airlines; but they have not induced any great enthusiasm on the part of passengers.

Basic Radio and Television Course

By *M. BERINSKY, E.E.*

MEMBER, INSTITUTE OF RADIO ENGINEERS

XXIII—RECEIVING SYSTEMS

THE receiver is a vital part of a radio communications system. Many possible methods for the reception of radio signals exist. Let us review, briefly, the component of an amplitude-modulated radio signal. Recall that the transmitter generated a high-frequency A.C. signal consisting of a high-frequency wave which was made to vary in amplitude at an audio frequency rate. The high-frequency wave was generated by the oscillator, and was varied in amplitude by the modulator.

The complete signal contained the carrier wave and the audio side bands. An outline of the peaks of the complete signal was seen to contain the same audio components that were introduced into the transmitter at the microphone. Both the positive and negative peaks contained the complete audio components. This is due to the fact that the audio signal at the microphone caused the radio-frequency wave to vary at its positive and negative peaks, this variation being at an audio rate.

In order to receive an amplitude-modulated signal several facts must be kept in mind. Since the signal is fundamentally an A.C. signal, it can be received by a circuit which will respond to an alternating current or voltage. We know that different stations contain unlike frequencies. In order to receive A.C. signals of widely different frequencies it is necessary to use some type of tuned circuit, such as a series resonant circuit. The tuned circuit should have a high "Q" in order to have a large amount of gain and sharp selectivity.

The Crystal Detector

Since the audio variations appear in both the positive and negative peaks, it will be necessary to make use of either the positive or negative peak, but not both. In order to utilize one or the other peaks of an A.C. wave some type of rectifier is required. This rectifier may consist of a crystal or a vacuum tube. The receiver should also contain an electro-mechanical device which will vibrate mechanically when influenced by electrical impulses. Such a device may be a pair of earphones or a loudspeaker.

The simplest type of practical receiver is called the crystal detector. This circuit consists of an antenna coil, also called an antenna coupler; a crystal of galena which acts as a rectifier; a variable condenser, and a pair of earphones. Fig. 1 shows the tuned circuit, consisting of the antenna coil, tuning condenser, antenna and ground.

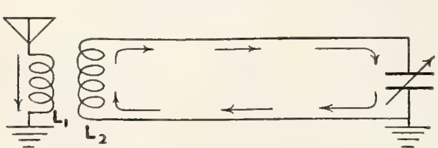

FIGURE 1. *The tuned circuit.*

The incoming signal appears between antenna and ground. This signal will cause a current to flow in the primary of the antenna coil, designated as L_1 in the diagram. The arrow to the left of L_1 shows the direction of this current for one-half cycle of the incoming signal.

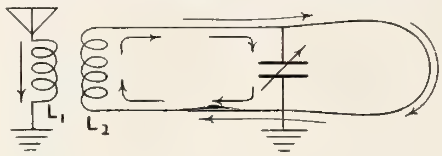

FIGURE 2. *Tuned circuit with a loop of wire as the load.*

It will be remembered that a radio wave consists of electrostatic and electromagnetic lines of force. The electromagnetic lines of force in the primary of the antenna coil will link with the secondary winding and will induce a current in the secondary. The secondary winding is designated as L_2.

The alternating currents of radio frequency are transmitted through all parts of the tuning circuit. The frequency of the current flowing in the tuned circuit is the same as that in the antenna-ground system. The variations in amplitude of each cycle will likewise follow the variations in amplitude of the current in the antenna-ground system.

Resonant Frequency

The condenser is charged by the current flowing in the tuning circuit. If the current in the antenna-ground circuit were removed after an initial impulse, the current in the circuit would circulate back and forth. The condenser would charge and then discharge through the coil. The current would move with an oscillatory motion in much the same manner that a pendulum would swing. Eventually the current would become zero due to the losses in the circuit.

The rate at which the electrons move in the tuned circuit is determined by the size of the coil and cendenser. A large coil or condenser would tend to slow up the circulation of current in the tuned circuit. The frequency at which the current in the tuned circuit oscillates is known as the natural or resonant frequency. The formula for the values of inductance and capacitance at which resonance occurs is:

$$f = \frac{1}{2 \pi \sqrt{L C}}$$

The easiest way in which to change the resonant frequency of the tuned circuit is to use a variable condenser. This was done in Fig. 1. In practice, the current in the antenna-ground circuit is always flowing. When the natural frequency of the tuned circuit is the same as the frequency of the current in the antenna-ground system, the current in the tuned circuit will oscillate freely and with little opposition. This will cause a large voltage to appear across the condenser, and is known as the voltage gain in resonance.

If the resonant frequency of the tuned circuit is not the same as the frequency of the incoming signal, the current in the tuned circuit will not be able to oscillate freely, with the result that the incoming signal will be incapable of producing a large voltage across the tuning condenser.

The following facts will help to explain the action of the tuned circuit to different

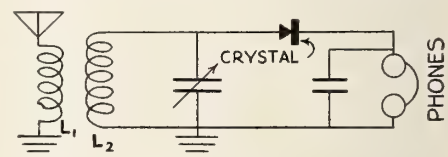

FIGURE 3. *Complete crystal detector.*

frequencies. Suppose that two stations, WJZ-770 KC and WOR-710 KC are inducing currents in the antenna-ground systems, L_1 of Fig. 1, and the tuned circuit, consisting of the coil L_2 and the variable condenser, is tuned to 770 KC. The natural frequency of the tuned circuit would be the same as the frequency of WJZ and its signal would produce a fairly large voltage across the variable condenser.

If WOR were also capable of producing a large voltage across the condenser when it is tuned in conjunction with L_2 to WJZ, both stations would produce large signals at the receiver and would be heard simultaneously. Fortunately, the tuned circuit is unable to oscillate freely at the frequency of WOR in the example given here, and it is possible to hear only one station at a time.

If WOR is desired, it will be necessary to change the setting of the variable con-

denser so that it will cause the natural frequency of the tuned circuit to change from 770 KC to 710 KC. Under these conditions WOR would develop large voltages across the condenser; while WJZ would be incapable of producing voltages large enough to be reproduced by the receiving system.

Tuned Circuit Anatomy

The ability of a tuned circuit to separate stations is known as selectivity. Not all tuned circuits tune sharply; they are known as broadly-tuned circuits and have poor selectivity. Sometimes we hear two stations simultaneously. If these stations are on different frequencies, the reason why we hear them simultaneously is probably due to poor selectivity.

We have seen how the tuned circuit selects or rejects certain radio frequencies. Let's assume that the tuned circuit is adjusted so as to receive WJZ. Merely receiving the signal from WJZ is not sufficient to enable us to hear it.

It will be remembered that the frequency of WJZ is 770 KC, which is much too high to be heard. In order to hear

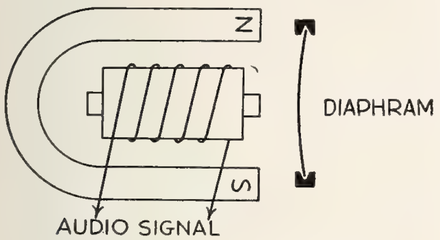

FIGURE 4. ***The earphone.***

the signal that is being fed into the microphone at WJZ's studio, it is necessary to insert some circuit which will respond only to the peaks of the signal coming from WJZ, because the audio component is contained in the variations of these peaks. Just how this is accomplished will now be explained.

Suppose that a loop of wire is connected across the condenser as shown in Fig. 2. The current that flowed through the tuning circuit in Fig. 1 will now divide and some of this current will flow through the loop. On the next half-cycle the currents in every part of the circuit will reverse, which means that an alternating current would flow through the loop.

Action of Crystals

We will recall that it is necessary to utilize only one half-cycle of the incoming signal in order to restore the audio component at the earphones. This means that a rectifier should be inserted somewhere in series with the loop. Fig. 3 shows the same circuit as is shown in Fig. 2, except that the loop has been replaced by a series circuit consisting of a crystal and a pair of earphones.

The crystal shown in Fig. 3 may be of carborundum or galena (a mineral compound consisting of lead and sulphur). Galena is the substance most commonly used in crystal detectors. Crystals have the property of allowing current to flow through them in one direction but not in the other. Not every point on the surface of the crystal has this property and the sensitive points have to be found experimentally by probing the surface with a very fine wire called a catswhisker.

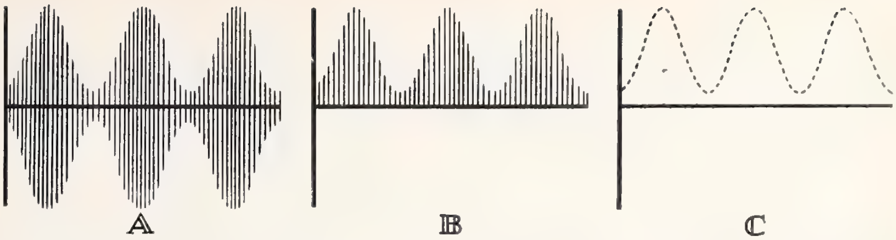

FIGURE 5. ***(a) Wave-form of the signal leaving the transmitter, entering the receiver (antenna-ground circuit) and entering the tuning circuit; (b) rectified current flowing through the crystal detector. This current is pulsating direct and contains high-frequency components. (c) Fluctuating D. C. through the earphones. The high-frequency component has been removed.***

Due to the presence of the crystal, the current flowing through the phones will be pulsating D.C., the frequency of which is too high to cause the diaphragm of the phones to move, since the diaphragm has too much inertia to move at the rate of one million or more vibrations per second. The frequency variations contained in the peaks of the pulsating D.C., however, are of an audio type, the highest frequencies being less than 10,000 cycles. The phones could easily vibrate at these frequencies.

It may be seen in Fig. 3 that a condenser is placed across the phones. This condenser charges along the peaks of the signal flowing past the crystal. The phones are made of many turns of fine wire and have considerable inductance. The current flowing through the crystal contains a high- and a low-frequency component, but the former cannot pass through the phones because of the high reactance offered thereby.

The condenser which is connected across the phones has a fairly large time constant, which means that it cannot follow the rapid variations which are present in the high-frequency component of the rectified current. It may also be said that the condenser has a low reactance to the high-frequency component, and the voltage drop across the condenser, due to this component, will be very small and may be ignored.

The condenser can, however, charge to the peaks of the rectified current because of the lower frequency of these components. The condenser has a high reactance to the low-frequency component, and a large voltage will develop across the condenser which will very nearly approximate the wave-form of the peak variations.

The voltage which appears across the condenser due to the low-frequency component will cause a current to flow through the phones. This current will flow easily because its frequency is in the audio range. The phones will not offer much reactance to this current, since the reactance is eual to $2\pi fl$ and will be small if the frequency is small. The variations in current through the phones will cause the diaphragm to vibrate at an audio rate. The vibration of the diaphragm will disturb air particles in front of it and the result will be a sound.

In practice the condenser across the phones is usually omitted. It will be remembered that a condenser consists of conductors separated by insulators. A coil will have distributed capacitance because a condenser is formed between adjacent turns. The distributed capacitance of the coils forming the earphones is enough to serve for detection purposes, and the fixed condenser shown in Fig. 3 may be omitted.

It is interesting to observe how the phones operate. Fig. 4 shows the construction of an earphone. A permanent magnet causes the diaphragm to bend inward slightly. When audio signals enter the coil, magnetic fields are set up around the coil and an electromagnet is thus created.

When the field around the electromagnet aids the field set up by the permanent magnet, the diaphragm

(Continued on next page)

APRIL QUESTIONS AND CORRECT ANSWERS

1. **(Q) What is the purpose of the speech amplifier?**
   (A) The speech amplifier provides driving voltage for the modulator.
2. **(Q) What is the purpose of the modulator?**
   (A) The modulator causes the RF wave to vary along its peaks at an audio frequency.
3. **(Q) What is the function of the neutralizing condenser in Fig. 6?**
   (A) The neutralizing condenser overcomes the effects of the grid-to-plate capacitance of the triode tube, and prevents the generation of spurious oscillations.

The Rugged Road to Radar Reception

RADAR is based on simple principles. But they couldn't be put to work until engineers had developed a completely new set of equipment to harness the tremendously high frequencies—billions of cycles a second—at which radar operates.

A new-type electronic tube was needed to generate these frequencies (the magnetron). Another was required in the receiver (the klystron). Still other equipment was necessary to control the radar beam, to detect it, amplify it, and make its message meaningful. All these devices, engineered from the ground up, were created over a few short years to make radar the phenomenal success it is. Hundreds of scientists working in many laboratories cooperated closely in these developments.

One of the first needs was for a switch thousands of times faster than any previously developed. It had to operate in one hundred millionth of a second and it had to repeat this performance a thousand times a second. Westinghouse research men made a major contribution to this need by developing an electronic switch called a TR (transmit-receive) tube.

The TR tube stands guard between the transmitter and the receiver, both of which share a single radar antenna. Since the outgoing burst of energy from a radar transmitter is a powerful blast, it is vital that not more than a minute part of this power get into the sensitive receiver. Otherwise, havoc would be wreaked on the tubes and circuits that are set up to detect the weak return signal.

Millionth-Second Action

On the other hand, the receiver must be ready instantly to take over after the transmitter has done its work, in order not to miss any nearby and potentially most dangerous echoes. Because a radar beam travels with the speed of light—186,000 miles a second—the receiver must be first disconnected and then reconnected to the antenna in about a millionth of a second.

The TR tube performs this lightning-fast job by providing a short-circuit path for the transmitter power. The "path" is a tiny gap between two needle-like copper conductors that are enclosed in a gas space of controlled and constant pressure. Normally, this gas is an excellent insulator and prevents the flow of current; but when a burst of power is sent from the transmitter the relatively high voltage "jumps" the gap and by-passes the receiver completely on its way to the antenna.

A few millionths of a second after the outgoing pulse is sent, the TR tube is ready for the weak return signal. Because this signal is of very low power—a few millionths of a watt—it is unable to break down the gap. Hence, it passes unhindered into the receiver where it is detected, amplified, and recorded on a fluorescent screen.

The problem of detecting the weak echo signal was another tough one for radar engineers. In radio this job is done by an electronic tube that takes the broadcast signal from the antenna, rectifies it, changes its frequency to one that can be heard by the human ear, and transmits it to the amplifier. But such a tube is literally too slow for the billion-cycle frequencies of radar, even though the electrons may travel across the tube at speeds as high as three million feet a second.

Crystal Echo-Catcher

A detector no larger than a small caliber bullet was developed by Westinghouse research men in collaboration with other scientists. It consists of a tiny silicon crystal; a "cat-whisker" probe of fine tungsten wire; and a porcelain cartridge to hold the device.

When the returning radar echo enters the receiver it impresses a small voltage, or electrical pressure, on the crystal. This causes electrons to flow from the crystal to the cat-whisker probe, the tip of which makes bare contact with the crystal surface. Because the crystal and probe are touching, there is no delay in transfer of electrons and the rectified current flows instantly.

These two developments, coupled with scores of others, helped put radar on the road to speedy success. Not only that, but they provided engineers with new knowledge and tools of great value in television, high-frequency heating, and other electronic fields.

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will bend toward the electromagnetic pole piece. When the field of the electromagnet is in opposition to the field of the permanent magnet, the diaphragm will snap back, since it was held in tension by the permanent magnet. The fields around the electromagnet change polarity because the audio signal which enters the coil is an alternating current.

Varied Signal Wave-Forms

Figure 5 shows the signal wave-forms existing in the various sections of the crystal receiver. Fig. 5a shows the wave-form of the signal as it leaves the transmitter antenna. The signal reaching the receiver and appearing in the antenna-ground circuit will have the same wave-form. This signal will be transferred by transformer action to the tuned circuit consisting of the coil L_2 and the variable condenser and will have the same wave-form as the signal in the antenna-ground circuit.

The current flowing through the crystal is shown in Fig. 5b. This current is seen to contain the high-frequency components that were present in the original signal. It will be noted that the current wave-form shown in Fig 5b is of a D.C. form, the result of the rectifying action of the crystal.

Figure 5c shows the wave-form of the current through the phones. This current is a fluctuating direct type and does not contain any high-frequency components. This current is shown by a broken line due to the fact that spaces exist between the peaks of the incoming signal. The time between these spaces is only a few millionths of a second, meaning that their frequency is too high to be heard. The resultant sound which is heard is as if the line in Fig. 5c were smooth and is, to the ear, an exact reproduction of the sound which entered the microphone at the transmitter.

The crystal detector is known as a weak signal or square-law detector. The term "square-law" is applied to a detector in which the rectified output is proportional to the square of the effective value of the applied signal. Galena crystals operate with very light contact pressure, are very sensitive, and have the disadvantage of being delicate and unstable.

Silicon, iron pyrites, and carborundum will operate with higher pressures than galena, but are correspondingly less sensitive. These crystals are also more stable than galena. The only present use of crystal detectors is in ultra-high frequency work.

MAY QUESTIONS

1. How are different stations tuned in?

2. Why is a large amount of selectivity desired?

3. Name two disadvantages of crystal detectors.

The answers to these questions will appear in the next issue.

Super Simplex Parts Book

A new parts book which will assist the users of Super Simplex Projectors in ordering replacement parts with ease and accuracy, has just been issued by National Theatre Supply. Like its predecessor, featuring the Simplex E-7 Projector, the new book makes use of the modern illustrative technique known as the "exploded view", by means of which each part may be clearly seen in relation to its associated units in each assembly. With the aid of this guide, it is only necessary for the projectionist to locate the parts he wants in the illustration, jot down the parts number and place his order with his nearest National branch.

A third book of a similar nature, featuring the Simplex Regular Projector, will be issued shortly and made available to users of this type of equipment.

Presenting: James A. Whitebone

BREAK-INS to theatre work are accomplished in devious ways but seldom it is that a kid uses his older brother stagehand as a means for playing hookey from school. Yet that's how it happened with James A. Whitebone, whose hookey-playing very definitely was not reflected in his subsequent career as business agent and financial secretary of Local Union 440, St. John, N. B., Canada.

St. John, let it be known, is cradled in a bit of the loveliest country (in the *summertime*) on this or any other continent, the area being known as the Maritime Provinces of Canada.

Jim Whitebone's preliminary passes at show business followed the well-worn trail so familiar to us all: an "operator" after school (yes, he finished) and nights for picture "specialties" sandwiched in between the offerings of a repertoire company, 1907 vintage; then a full-time assistant at $7 weekly (big money for a kid those days) for 10½ hours each of the six days.

Projectors were the Edison Kinetescope which, mounted on ordinary tables, had neither upper nor lower magazines, the film running through a hole in the table into a bag underneath. The film was rewound onto the upper spindle by finger-power, and it was just too bad if one lost the end of the film in the bag.

An Imposing Labor Record

Followed for Jim a number of years in local theatres and on tour, and then (it always happens) a stretch of service as a stagehand; but since 1932 projection has claimed Jim for its own in a Famous Players Canadian theatre.

Jim's services to Labor have been intensive and varied enough for any one man. Lend an eye to this: president, then business agent and financial secretary of Local 440 for the past 25 years; delegate to every I. A. Convention within that time period, except for two during the war years; president of St. John Trades and Labor Council for 15 years, then resigned to become secretary-treasurer, which post he still holds; president of the New Brunswick Federation of Labor for 15 years; in 1938 named a vice-president, and now senior v.-p., of the Trades and Labor Congress of Canada.

In 1929 Jim was the Fraternal Delegate representing Canada at the A. F. of L. Convention, in which capacity he addressed the gathering immediately following Ramsay MacDonald, then Prime Minister of England. As a representative of Canadian labor, Jim was a delegate to the World Trade Union Conference held in London, England, in February, 1945, following which he toured the Western fighting front and visited Canadian and United States troops in Belgium, Holland and Germany.

Jim is no stranger to the soldier's life, having served during World War I as an infantryman, and in the latest imbroglio as an officer with the Reserve Canadian Artillery, to which he still is attached. He was presented to King George VI and Queen Elizabeth of England when they toured America in 1938.

What, no time for civic duties? Certainly, for Jim is now a member of the St. John City council, being elected in 1936 as the first official Labor candidate to make the grade. With the remaining 11 seconds of leisure time Jim does nothing—nothing, that is, except breed cocker spaniels and engage in a bit of gardening and woodworking. The cockers incidentally, are right up there and have done considerable winning at dog shows in Canada and the U. S. Jim is a member of the New Brunswick and the Canadian kennel clubs. Oh, yes, this exponent of perpetual motion is also active in Masonic circles.

Quite interesting is the Whitebone credo anent labor unions, excerpts from which follow: "Thirty years as a trade union official have not changed my view that labor unions, properly operated and with due regard for the rights of others, are the greatest instrument yet devised for promoting the welfare of the worker and his family.

Union Organization Credo

"I have no illusions as to the danger of faulty organization and direction of unions, but I believe that unions in general contribute mightily to the progress of any industry. This has been amply illustrated in our own field wherein the chaotic conditions of some years ago have yielded to a progressively better mutual understanding between worker and employer, with the industry overall being the gainer.

"However, every advantage gained by a labor union actually imposes thereon increased responsibilities to do better that job for which the worker is hired. Smugness, self-satisfaction and false ideas of power not only do not enhance the prestige of a union but are detrimental to its progress. Good work, craftsmanship is the best contribution any union man can make to himself and his brother union fellows."

Verily, they grow them stalwart in the Maritime Provinces.

GPE Denies Govt. Charges in Scophony Trust Suit

General Precision Equipment Corp. and its president, Earl G. Hines, have filed a joint answer in Federal Court in New York City to the Government's anti-trust action involving Scophony television developments. Other defendants in the action are Paramount Pictures and its subsidiary Television Productions, Inc.; Scophony Corp. of America; Arthur Levey, head of SCA, and Paul Raibourn, president of Productions.

Scophony Corp. of America was formed as a subsidiary of Scophony, Ltd., of London, to exploit certain television developments owned by the latter. Participating stockholders in SCA were Paramount Pictures through its subsidiary, Productions, and General Precision. For a consideration estimated to approximate $200,000, both General and Productions were granted licenses to manufacture and sell Scophony equipments on a royalty basis, as well as to conduct experimental work and lend active aid in expanding the number of Scophony licensees.

Scophony Remiss, Says GPE

The Government charges that the defendants conspired to restrict manufacturing and experimental work and to deny licenses to other manufacturers. The defendants aver, in substance, that Scophony neither had nor supplied the means to make possible such action, and that repeated offers of licenses found no takers.

Moreover, there existed a serious internal controversy between Productions (Paramount) and General on the one hand and the president of SCA (Levey). General's answer sets forth bluntly "its complete loss of confidence in the president of SCA" (Levey). Said Mr. Hines:

"We think our answer constitutes a complete refutation of the Government's charges . . . The facts are completely at variance with the Government's charges . . . and could easily have been ascertained before the suit was instituted."

It was pointed out that should the Government be successful in its suit the only practical result would be to place the Scophony patents in the public domain and thus render them usable by anyone who so elected. This happening would, in effect, place "independents" such as General and Productions at a serious disadvantage when the inevitable adjustments are concluded between the larger tele interests and those operating on a smaller scale.

The speeds of electrons as they strike the target in x-ray tubes are very high. In a 300,000-volt tube, for example, they reach speeds of 149,000 miles a second, or about 80 per cent of the velocity of light. Temperatures reach about 6000° F. in a second or less.

TELECASTS

CBS has successfully transmitted color television images over coaxial cable facilities between New York and Washington and return, a distance of 450 miles, and the images apparently suffered little by being confined to the channel, hitherto deemed suited only for black-and-white scenes.

The test was made in cooperation with engineers of the American Telephone and Telegraph Co., who set up a "loop" in the existing coaxial facilities to gain the greater distance. The test consisted of sending colored motion pictures and lantern slides, also ordinary black-and-white television scenes.

Frank Stanton, president of CBS, said the demonstration had revealed that even though the definition of color pictures was "decreased to some degree" by the present characteristics of the coaxial cable, the added effectiveness of color compensated for the loss.

No changes were made in the usual circuits to favor the color images, it was said. The coaxials are "terminated" to cover a channel of only 2.7 megacycles, or 2,700,000 cycles, which is the regular circuit arrangement for black and white, an A. T. & T. engineer said. The CBS color channel is 10 megacycles wide. For comparison purposes, ordinary black-and-white "low-frequency" standard images were sent over the same channel and broadcast over the regular CBS television station. Thus, both color and black-and-white were viewed side by side for comparative results.

Tests also were made by sending the color images over the 450-mile loop and comparing them with black-and-white not sent over the circuit. This is said to have revealed a "superior beauty and appeal" of color even though it had been subjected to the cable test, whereas black-and-white had not.

CBS contends that network color television is thus "fully practicable" at the present time, that it may be carried without modification of present coaxial systems and therefore is as adaptable as black-and-white. He said this eliminates the last major objection to color for network use and brings it into the "realm of fact."

A representative of A. T. & T. said the coaxial cable as a system for any type of television is believed to be adequate for distances up to 1,000 miles, but beyond that, "transmission trouble might be expected." But even this limitation, he added, will be removed in time.

* * *

Successful transmission of color television over a coaxial cable from New York to Washington and back, a total of 450 miles, was followed by CBS announcement that it plans to extend its color video demonstrations to Chicago and Los Angeles. Web plans to impress ad agencies, sponsors and general public that color tele is ready for commercial broadcasting right now.

CBS admits that the 450-mile tele transmission was a bit off in definition, but ascribed this to present characteristics of the cable, adding that addition of color compensated for the loss and contributed greater beauty and appeal than would black-and-white.

* * *

CBS battle for "color tele now" apparently favored by the withdrawal of 33 applications for black-and-white stations during the past few weeks. Latest and probably the most important to announce its decision to await color is Walt Disney, who had applied for Channel 5 at Los Angeles.

Petition for the dismissal of the Disney application "without prejudice" stated that a detailed investigation of video had convinced petitioner that color is just as essential for the "type of television programs he (Disney) proposes to render" as it is to his animated motion pictures. However, Disney added, he plans to continue his tele program, and when color video becomes established on a regular commercial basis, to seek a permit for such a station.

This swarm of withdrawals occasioned great joy in the CBS camp, which has been battling the black-and-white-now forces headed by RCA. Intimations that RCA was getting set to back down on its former stand and embrace color tele full-blown right now drew a sharp denial from RCA's prexy David Sarnoff, who reiterated that RCA will not go in for color tele until an all-electronic system is devised, the date for which has been set as five years in the future.

RCA points out that it has never denied the superiority of color tele, but stated that an all-electronic system is absolutely necessary to establish a firm commercial basis for operations. To this end, RCA is continuing tooling up for b-and-w video.

* * *

Television receivers requiring 6,000 to 30,000 volts for operation of either direct-viewing or projection-type picture tubes, use compact power supplies that rectify radio frequency voltages to obtain high D.C. output for low load currents. Filter capacitors on the order of 500 micro-microfarads are adequate, reducing size and cost as well as shock hazard.

In quantity production these high voltage supplies may cost less than a power transformer alone, helping to lick another economic hurdle for the television industry.

* * *

Peculiar reaction of iconoscope tele camera to colors and patterns was discussed at recent video symposium. Older "ikes" were sensitive to reds, whereas the new ones are sensitive to blues. Also, new "ikes" resolve colors into as many as 40 different tones of grey. Because blacks usually produce halation, trailing or flares, true black effects are obtained with dark greys or equivalent colors.

There still is no agreement on whether the best studio illumination is obtained from "inkie," fluorescent, or arc lighting. "Inkies" are generally favored, with hope held out that new heat-dissipating devices may improve studio operating conditions.

* * *

DuMont demonstrated the taking of 16-mm transcriptions of tele programs. They recorded the film from a monitor screen during actual video program, then projected it immediately. Both silent and sound films are adaptable for this purpose.

* * *

Described as an entirely new idea in tuning mechanisms, a continuously variable device which, without switching, will cover the entire frequency range from 44 to 216 megacycles, taking in all 13 tele channels as well as the FM section of the spectrum, has been introduced by Allen B. DuMont laboratories.

The device is pre-adjusted and calibrated in assembly, assuring simplification of tuning and minimum drift in station selection. This "Inductuner" will be standard equipment on all DuMont telesets.

* * *

First licenses embodying CBS' ultra-high frequency television inventions went to Westinghouse Electric Corp. Arrangements, on a patent royalty basis, are for five years and provide for an extension of the agreement. Royalties to CBS range from 25 cents to one dollar on receiving sets, depending on the retail price, and one per cent of the net selling price of complete color television transmitter studio apparatus.

* * *

NBC has issued a brochure in which advertising agencies and clients are invited to participate in commercial tele broadcasting. Production procedure and program changes are detailed, along with three plans of operation, as follows:

First, production of original material

for "live" broadcasts; second, for those who create original material for NBC adaptation; third, for those for whom NBC will produce. Stated charges are $100 as the basis transmitter charge for 11 minutes to 1 hour, day or night; $75 for 10 minutes. Use of studio for 1 hour will cost $750, a half hour $500, a quarter hour $300, and $125 for 10 minutes. A comprehensive outline of the basis for production charges is given in the brochure.

* * *

Tele rights to the Joe Louis-Billy Conn fight on June 19 next have gone to NBC on an exclusive basis. NBC will not film the fight for repeat telecasts, these rights having been acquired by RKO-Pathe, which will do the shooting, scoring and cutting.

Five cameras, three image Orthicons will be used, with a technical staff expected to number 30. The telecast will be carried to Philadelphia and Washington on a closed circuit. Video people hope that this event will help television to the same extent that the Dempsey-Carpentier fight helped radio.

NBC has officially denied that the fight will be shown via theatre television. This sets at rest rumors that large-screen presentation of the fight would be handled by the Paramount Theatre in Times Square, N. Y. City.

* * *

Development by the General Electric electronics department of a "pulsed light" film projector for television stations has been announced. Device, which eliminates the need for a mechanical shutter, uses a mercury capillary lamp whose light pulses are timed and controlled by signals from the television station's synchronizing pulse generator, which also times the sweeps of the tele camera tube that views the film frames.

Projector will be sold in 16- and 35-mm sizes as a product in the GE television station equipment line. Advantages claimed include elimination of excessive vibration from the conventional high-speed shutter, relaxing strict motor phasing requirements, and comprehensive switching in network operation as simple methods to make the projector "follow" station synchronizing can be used.

* * *

Future possibilities for nation-wide distribution and projection of theatre television was experimentally demonstrated recently by General Electric at a private 30-minute show which combined the facilities of tele station WRGB and the Civic Playhouse in Schenectady, N. Y. Micro-wave equipment was used to send the program from WRGB to the Playhouse where it was flashed on an 11 x 15 foot screen by a tele projector made by the Rauland Corp of Chicago.

Program consisted of films provided by 20th-Fox, and a live talent show produced by the WRGB staff. As the station's cameras viewed the performances, scenes were fed via coaxial cable to a special low-power micro-wave transmitter located on a tower adjacent to the studio. Transmitter output was then beamed by directional transmitter antenna toward the Playhouse. Here another directional antenna picked up micro-wave transmission and supplied energy via coaxial cable to a special FM picture receiver.

Latter unit fed the picture signals to the Rauland tele projector which flashed them on the screen. Sound was also transmitted from studio to Playhouse via a radio link. This was the first time a micro-wave relay equipment has been used to feed tele signals to a theatre for large screen projection.

Demonstration was part of a broad research program being carried on by the two organizations whose engineers expect significant improvements. Micro-relay equipment was part of that developed for the Schenectady-New York radio relay network.

Immediate Delivery on DeVrys

DeVry Corporation, Chicago, has completed its U. S. Navy commitments for 35-mm motion picture sound equipment, and orders are now being accepted for immediate delivery of projectors for civilian theatre installation. DeVry's enviable wartime production record is attested to by five consecutive Army-Navy "E" awards, the only manufacturer thus honored for excellence in the production of motion picture sound equipment.

Extensive wartime experience will contribute much to improved equipments.

BUCKY SYSTEM OF 'LIVE' SOUND REPRODUCTION

(*Continued from page* 15)

greater part with most of the other instruments.

If we consider the quantitative proportion of direct and reflected sound striking our ear, we see that there is a great difference between the wind instruments and the other instruments. However, we cannot assume that the wind instruments give a superior artistic effect. On the contrary, we have found that the suppressed directional effect of orchestra music and even distribution produces a rather pleasing effect—the impression of being surrounded by sound and of being relieved of the effort to focus the attention to an individual instrument which is quite often disturbing if the directional effect has not been suppressed.

Our experiences have led us to the conclusion that an even distribution of sound with suppression of the directional effect represents an essential progress in the phychological artistic respect. Our opinion was confirmed by leading musicians and conductors who called the effect startling. We claim that traditional assumptions have to be modified. We must not forget that the ideal arrangement and location of an orchestra would be in the center of a hall. However, the circular arrangement of the instruments would make it impossible for the conductor to give directions to the individual musicians.

Multiple Speakers Used

A special problem is the reproduction of speech. In this case, intelligibility is affected greatly by reverberation. If reverberations come from comparatively long distances, the speech becomes unintelligible owing to time intervals of the sound waves. A simple solution of the problem is to use a number of low-powered loudspeakers distributed evenly over the listening area to reduce reverberation and to have the sound travel and be reflected vertically instead of horizontally in rooms or halls the height of which is shorter than the length.

However, there exists the assumption that the desired illusion is interfered with if the sound does not come direct from the stage. This conclusion has arisen from a very peculiar coincidence.

As mentioned previously, speech and song are emitted semispherically in a horizontal direction. When they are generated by the ordinary type of loudspeakers, a beam is emitted (as in a brass instrument) with its specific directional effect. If such a loudspeaker is placed in an unfamiliar location, no doubt the effect must be highly disturbing. We have found that evenly distributed sound does not apear disturbing. It is amazing how the listener can be misled by his imagination when there is no directional effect present.

We have an installation in a room with a piano. When piano pieces are played over the loudspeaker system without directional effect, quite a number of listeners assume that the speakers are in the piano. This proves that an action takes place in the brain, similar to looking at a stereoscopic picture. Psychological experience is substituted for physical facts.

Installation Requisites

Another advantage is greater apparent brilliance of the sound. Music in an unenclosed space, such as at an open air concert, appears flat owing to the lack of reverberation. If the same waves strike the ear at imperceptible time intervals, the sound gains in brilliance and becomes "three-dimensional." This is a well-known fact. With our system, this effect is especially noticeable and contributes to the pleasing impression.

Our system uses 3 frequency ranges

which are amplified separately. The following rules for installation have been arrived at from the conclusions of our psychological experimentation:

(1) No sound beam must be pointed directly at the listener.

(2) The high-frequency range must be reflected from the floor by directing the loudspeaker toward the floor.

(3) The medium range must be reflected from the ceiling by directing the loudspeakers toward the ceiling.

(4) The low range must travel on and parallel to the floor.

(5) In large rooms, an attempt should never be made to cover the entire space by means of a single loudspeaker for the individual range.

An explanation for the resulting psychological effect, as described previously, cannot be found by physical measurement. As we do not know the transmission curve of sound waves into electro-chemical nerve stimulation in the ear, we must restrict our observation to empirical experiments. Up to now, we have not found a means for exact physical measurement. However, we can assume with certainty that the psychological curve does not coincide with the curves of the physical sound measurement apparatus.

Elaborate Wiring Needed

As our system requires a multitude of loudspeakers, a rather elaborate wiring system would be required. We have, therefore, developed a wireless system using a wavelength distant from presently utilized frequencies. Therefore, interferences are out of the question.

The current coming from the microphone or the pickup is connected to a radio transmitter. The radio waves travel over the power line in the well-known way. Filters installed in the fuse box prevent these frequencies from reaching undesired directions in the circuit in order not to disturb neighboring localities. Each loudspeaker is equipped with its own receiving amplifier and an adequate filtering system. This arrangement has an advantage in that all its parts may be manufatcured in mass production.

No special amplifiers have to be designed for the size of the hall to be equipped and only the number of loudspeaker units has to be increased. This system is, therefore, very flexible and may overcome comparatively easily the acoustical shortcomings of the room.

We are confident that our system proves that for real artistic reproduction of sound, psychological and physiological factors are at least as important as physical measurements.

DeVry Marks Reconversion Date

Celebrating the conversion of its manufacturing facilities and products from war to peace, DeVry Corp. gave a Victory Dinner to its suppliers on Tuesday, April 23, at Chicago's famed Svithiod Club. The dinner was attended by manufacturers whose wartime deliveries helped DeVry win five consecutive Army-Navy "E" Awards for excellence in the production of motion picture sound equipment, and who are now helping speed DeVry 16-mm and 35-mm projection and sound equipment to meet civilian demand from all parts of the world.

The Four Basic Factors In Any Security Program

IN THIS era of violent transition in politics and economics the need for assurance of future security is reflected in the requests of Labor people for data that will lend an element of personal certainty. Of late many readers of I. P., particularly those in the older age bracket, have been asking for information relative to Social Security—what it is and how it works.

This inquisitiveness is all to the good, of course, and we are glad to oblige; but it occurs to us that the Social Security law in and of itself is only one facet of the overall problem of financial independence — a problem which demands consideration of cash savings, U. S. Government bonds, insurance and, above all, Wall St.

A few basic rules anent the foregoing are applicable to the problems of all of us, regardless of the size of our savings account or our current earning power.

U. S. Bonds Basic in Plan

U. S. Savings Bonds are the keystone of any security program. These bonds, the best in the world, pay almost 3 per cent interest and are redeemable at will. Hold the bonds you now have; don't cash in your bonds to buy some postwar gadget, but try to build a new savings account to pay therefor; continue your company payroll savings plan; reinvest cash received from matured bonds. These bonds and Social Security alone will take care of any reasonable retirement plan.

Insurance is the second "must" in such programs. Ordinary life policies are appropriate for those in the $2000 income group. The larger the income, the larger and fancier the policy, including those with special retirement features. But whatever the type of policy, insurance is basic in any plan.

As for the operation of the Social Security law itself, this system is a torm of minimum insurance in itself and, by reason of its fundamental place in any plan for the future, provides the basis for a greatly expanded retirement plan.

Speculation in stocks—in short, Wall St.—not only does not provide any magic formula for security but in fact constitutes a definite threat thereto. No consideration should be accorded such activity until the aforementioned basic essentials for a security program have been met. Definitely no place for wage-earners. Wall St. is no better than a speculation even for those who have sufficient money to buy corporate stocks.

Summed up, any sensible program for safeguarding present savings and providing assurance of future independence should be built upon a foundation of the Social Security law, plus insurance, plus the retention of U. S. bonds now owned and the continuing purchase of same, plus the reinvestment of the proceeds of such bonds when they mature, plus the abstention from speculation in corporate stocks.

Now They're Telling Us

On Navy Day in New York, television accomplished two feats which motion pictures, after a generation of experience, cannot yet approach:

1. A large dinner party at the Waldorf was clearly pictured for the NBC television audience, using only the regular hotel lighting, which was far too dim for the taking of any movies.

2. A newsreel dropped from a blimp was hurriedly developed and the *negative* run through the television projector, without the delay necessary to print, develop and dry a positive. Yet the television audience saw a *perfect positive* by the simple expedient of *electrically* reversing the negative picture.

And that's something else Messrs. Pathe and Paramount can't yet do—project blacks as whites at the flip of a switch. Next!—*Electronic Industries.*

[This is the thanks we get for teaching those electronic-mad mugs the difference between a negative and a positive. Still, can these guys *unconsciously* project whites as blacks, "without the flip of a switch," as we do through the media of low-key lighting, soft-focus lenses, low-intensity lamps, dirty screens?—Ed.]

BOOKS RECEIVED

TELEVISION—EYES OF TOMORROW, By Capt. William C. Eddy (U.S.N., Ret). 330 pp., 136 illus., cloth binding 9 x 6. (Prentice-Hall, Inc., 70 Fifth Ave., N. Y. City; $3.75).

Here is the whole story of television from its feeble beginnings as an electronic orphan to its present position of technological eminence. Its author, Capt. Bill Eddy, an acknowledged expert in the video art, is a special friend of show-business people by reason of his six-year association with Balaban & Katz in Chicago, whose tele station WBKB he built and still directs.

Capt. Eddy's book is a "must" for anybody desirous of gaining a well-rounded understanding of the tele art. The author runs the gamut of significant details—historical development, studio layout and operation, scripting, production and programming, and industry economics. He should know: he's been through the mill.

No involved mathematical treatise, this, but a straightforward, objectively-written job that offers essential information in down-to-earth language capable of being understood by even the non-technical reader. Illustrations suit the text like a well-fitted glove. Unqualifiedly recommended for a comprehensive understanding of video.

TWO-WAY RADIO, by Samuel Freedman (Ziff-Davis Publishing Co., New York City, $5). 506 pp., profusely illustrated, cloth binding.

Describes the mechanics and applications of two-way radio for all forms of fixed, mobile or portable communications. It is presented in non-mathematical form and in simple language fully understandable to persons using or intending to use such facilities. Also included is a thorough description of induction radio and carrier current communication techniques. Author is an acknowledged expert in his field, having had 26 years experience in all forms of radio and electronics.

RADIO TEST INSTRUMENTS, by Rufus B. Turner (Ziff-Davis Publishing Co., New York City, $4.50). 219 pp., 182 illustrations, cloth binding.

Every conceivable type of test instrument required for broad-gauge radio engineering work is detailed herein, ranging from simple meters for current and voltage on through special-purpose bridges and accessories, oscilloscopes, oscillators and the like to the most complex measuring devices. The text is helped immeasurably by the many splendid illustrations.

Bell & Howell British Deal

Long-term agreements have been finalized between Bell & Howell Co., makers of precision photographic equipment, and British Acoustic Films, Ltd., of England, engineering and manufacturing facility of the J. Arthur Rank group. Under the arrangement, a complete interchange of research as well as manufacture and distribution of equipment is effected between the two firms. All 35-mm, 16-mm, and 8-mm B. & H. equipment will be made in England by B. A. F., Ltd., whose plants will be operated in strict accord with B. & H. engineering and production methods. Distribution of the English-made products will cover the British Empire and certain other countries.

SMPE 59th TECH MEETING

(*Continued from page 14*)

illuminant, on pairs of the illuminants which match, and on the roll played by fluorescent materials. At the end there was a brief discussion of the effect on these phenomena of visual color adaptation to the illuminant. It is shown briefly why some colors change from daylight to artificial light, and why some illuminants give different results than tungsten lights.

NEW FILM FOR PHOTOGRAPHING TELEVISION MONITOR TUBE

By *C. F. A. White-M. R. Boyer*

A film which is specially adapted for photographing images on the P-4 monitor tube surface has been prepared. Optical sensitization is adjusted to yield peaks of sensitivity within the blue to yellow spectral region corresponding to the emission of the P-4 screen. Resolving power of the film has been found of controlling importance when used in 16-mm size, and this factor has affected the choice of emulsion for this purpose. The film may be employed either as a negative or reversed.

ZOOM LENS WITH SINGLE BARREL LINEAR MOVEMENT

By *Frank G. Back*
Research and Development Labs.

Previous varifocal lenses used two or three movable components which had to be shifted against each other. This movement was necessarily non-linear and, therefore, had to be achieved by non-linear cams. This caused considerable mechanical difficulties and it was nearly impossible to obtain an accurately focused image over the whole range. In addition, the shifting of the movable components against each other caused considerable aberrations.

The new varifocal lens has only one movable barrel, and the compensation of the image movement is achieved solely by optical, and not by mechanical means. Therefore, the lens gives a well focused image, sufficiently free from aberrations at every position.

CONTROL OF THE SENSITOMETRIC DUPING PROCESS

By *J. P. Weiss*
E. I. du Pont de Nemours & Co.

Because of head-and-tail development effects, sensitometric exposures of the standard type cannot be wholly relied upon to give a true indication of picture contrast. A method is described whereby sensitometric exposures of unusual form can be used to establish processing techniques for making dupes. Good correlation with visual judgment of quality of a standard picture is obtained.

POST-WAR TEST EQUIPMENT FOR THEATRE SERVICING

By *E. Stanko and P. Smith*
RCA Service Company, Inc.

This paper outlines the underlying reasons for the need of new and modern test equipment for properly servicing theatrical sound reproducing equipment with the minimum expenditure of time. A detailed description is given of a modern test kit designed to fill this need. Individual instruments included in this kit are completely described. Photographs of the kit and schematic diagrams of its special instruments are included.

PHOTOGRAPHIC FILM, TELEVISION PICK-UP TUBES AND THE EYE

By *Albert Rose*
RCA Laboratories, Inc.

The picture pick-up devices—film, television pick-up tube, and the eye—are subject ultimately to the same limitations in performance imposed by the discrete nature of light flux. The literature built up around each of these devices does not reflect a similar unity of terminology. This paper is exploratory and attempts a unified treatment of the three devices in terms of an ideal device.

The performance of the ideal device is governed by the relation:

$$\text{scene brightness} = \frac{\text{constant (signal-to-noise ratio)}^2}{\text{picture element area x quantum efficiency}}$$

The three devices are shown to approximate this type of performance sufficiently well to use it as a guide in treating their common problems.

Simple criteria are derived for characterizing the performance of any one device as well as for comparing the performance of different devices. For example, quantum efficiency is used to measure sensitivity; the signal-to-noise ratio, associated with a standard element area, is used to measure both resolution and halftone discrimination. The

halftone discrimination of the eye governs the visibility of "noise" in the reproduced picture and, in particular, requires that pictures be photographed or picked up at increased scene brightness when the brightness of the reproduction is increased. The observation and interpretation of visual "noise" is discussed.

COMBINATION 16/35mm FILM PROCESSOR MACHINE FOR BLACK AND WHITE AND COLOR

By *William L. Proger*
Solar Aircraft, Hollywood

This short paper covers the title subject and describes the general construction and operation of the new "Fonda" developing equipment as fabricated by the Fonda Film Processing Equipment Division of the Solar Aircraft Co. and as screened by the 16-mm black-and-white sound film which followed the paper.

This Fonda model processes both 16- and 35-mm film without any change in operation other than the variable speed control. The patented Fonda rollers are designed to accommodate both widths of film without danger of the smaller 16-mm stock climbing up and onto the 35-mm film edge support.

The Fonda drive, entirely different from any other, practically eliminates film breakage and film damage from other mechanical causes. A constant tension in the film throughout its developing and drying process is maintained. Frictional drive is applied only when normal tension exists; the driving action is accomplished by the very light constant drag on the film throughout the machine.

The mounting of the film-carrying rollers on shafting that yields to the slightest additional tension, and downward, is owing to the spring-suspended saddle; thus the upper film carrying rollers are drawn away from the stationary driving rollers until sufficient slack feeds to relieve the tension and the rollers again contact the driving rollers which are out of tanks and solution.

The color processing unit can be added to the black-and-white developing unit without the necessity of duplicating any of the development steps of the black-and-white unit.

TELEVISION REPRODUCTION FROM NEGATIVES

By *E. Meschter*
E. I. du Pont de Nemours & Co.

The expected reproduction characteristics are examined for the cases where film is included as one step of the television process. Features of performance to be expected from both negatives and prints as image sources are predicted from average characteristics of elements of the television system. A dynamic test procedure for the investigation of the over-all reproduction curve involving film and television is described. Actual tests confirm the theoretical prediction that a negative film with a rising shoulder characteristic may provide superior television images.

CHARACTERISTICS AND APPLICATIONS OF W. U. CONCENTRATED-ARC LAMPS

By *W. D. Buckingham-G. R. Deibert*
Western Union Telegraph Co.

The concentrated-arc lamp,[1] a new type of light source, is basically an arc lamp which is provided with permanent fixed electrodes which are sealed into a glass bulb filled with an inert gas. The source of the light is a small incandescent spot which forms on a specially prepared refractory oxide cathode. When the arc is established, the oxide surface is raised to its melting point and a brilliant white light is emitted from the molten surface and a cloud of vaporized material which extends for a few thousandths of an inch from the cathode. This vapor is drawn back to the cathode, thus renewing the surface and resulting in lamps which have a life of several hundred hours.

The lamps are unique because, in various sizes their light emitting spot may be as small as 0.003 inch or as large as several tenths of an inch in diameter with brightnesses up to 100 candles per square millimeter. The lamps start almost instantly, burn quietly, have a continuous spectral

[1]See I. P. for April, 1946, p. 16.

distribution, and may be operated in any position.

In small sizes, the lamps are a close approach to a point source and have application to optical testing and demonstrating and lensless projection and enlargement. When used with optical devices such as photographic enlargers and microscopes, an image having unusual sharpness and depth of focus is obtained. The lamps work very efficiently in projector applications.

Cencentrated-arc lamps are made in A.C. and D.C. types, both of which require special auxiliary power equipment.

THE CBS COLOR FILM TELEVISION SCANNER

By *Bernard Erde*
Columbia Broadcasting System

The system of color television developed by CBS has been on demonstration since the first of the year. These color television pictures had their origin in color film and color slides. This paper is a description of the film scanning mechanism and associated optical, electrical, and mechanical equipment constituting the color film and slide pickup portion of the system.

The various inter-dependent functions of constant film drive, optical and electronic film motion compensation, heat and color filtering, and film and color phasing are discussed in detail. The method of optical alignment and a typical operating procedure are described.

THE PHOTOMETRIC CALIBRATION OF LENS APERTURES

By *A. E. Murray*
Bausch & Lomb Optical Co.

An absolute and physically sound method developed at Bausch & Lomb for the photometric calibration of lens apertures is described. Essentially, the method consists in comparing the total flux from a depolished opal glass aperture with the flux through a given lens at a definite stop opening when focused on the opal glass aperture. An integrating sphere is used to collect the flux in the two cases and readings are made proportional to the flux with two matched barrier layer photocells. The theoretical development and some numerical results are given.

LIGHTING A SUBJECT FOR COLOR PHOTOGRAPHY

By *Ralph M. Evans*
Eastman Kodak Company

The addition of color to photography introduces many problems which have been considered little, if at all, in black-and-white work. Those problems deal, for the most part, with the saturation of the colors and their dependence on the physical nature of the light source and on the exposure of the film. This talk deals systematically with the problems which are encountered when a photographer sets up a simple object in the studio and attempts to make a color transparency which looks like the object.

After considering the effect of the size, shape, and position of the light sources, some time is spent on the advantages and problems of polarized light. The appearance of shadows is then considered, both from the photographic and the psychological points of view; and techniques are considered for dealing with the problem.

By way of review, the talk ends with a consideration of subject and lighting contrasts in relation to speed and latitude of the film. The talk is illustrated by 150 colored pictures illustrating every point which is considered.

MODERNIZATION DESIRES OF A MAJOR STUDIO

By *Loren L. Ryder*
Paramount Pictures, Hollywood

Applying the science of war to peacetime can be a slow and laborious process. The process can be accelerated by long-range and overall thinking and expression on the part of industry to manufacturers and the engineers of experience. Now that restrictions are lifted, it can also be accelerated by a wider dissemination of information with regard to devices and methods which have application to motion picture making. The objective of this paper is to aid in the cooperative effort of gaining peacetime advantage from scientific developments of the last war.

DUBBING AND POST-SYNCHRONIZATION STUDIOS

By *William A. Mueller*

The paper covers design and operating considerations for two foreign-dubbing and "post-synchronization" studios recently built on top of the Music Bldg. of Warner Bros. lot in Hollywood. After describing con-

structional details to provide satisfactory acoustical conditions in the rooms, the paper concerns itself with the technique of adding foreign dialogue to completed pictures and dubbing in replacement lines to photographed sequences which, originally, were too noisy to permit the recording of intelligible speech.

THE HIGH COST OF POOR PROJECTION

By *Charles E. Lewis*
Editor, Showmen's Trade Review

Sampling the opinions of American theatre managers by means of a questionnaire addressed to selected groups of representative theatres reveals that unquestionable increase in box-office receipts follows any improvement in projection or sound equipment. This increased income is lost to the industry when projection is neglected. The best equipment, however, cannot get good projection out of mutilated prints, therefore the industry sustains additional loss through the carelessness of a few theatres. Still further loss results from shortening the life of prints.

What good projection is and how it can be obtained, therefore, are questions of practical, financial interest to everyone in the industry. They are discussed in this paper from the viewpoint of the *theatre manager*, not that of the engineer.

A PROCESSING CONTROL SENSITOMETER

By *Gerald A. Johnson*
Eastman Kodak Company

A sensitometer which gives an intensity-scale exposure has been developed as an aid to the control of photographic processing conditions. The illumination is modulated by a photographic step tablet of 21 steps in which the exposure increases by increments of $\sqrt{2}$. Positive films are exposed to an incandescent lamp operating at 2850 K; while with negative films dyed gelatin filters are inserted in the optical system to approximate mean noon sunlight quality (5400 K).

A pendulum mechanism furnishes a 1/10-second exposure time for positive and negative films. Where longer exposure times are needed, as, for example, with photographic papers, an additional manual shutter is provided. The instrument gives highly reproducible results for process control but is not calibrated in absolute units.

LIGHT CONTROL BY POLARIZATION

By *J. A. Norling*
Loucks & Norling Studios

Among the devices for light control are color filters for separation selection, for balancing the color of a light source to the color sensitivity range of a photographic emulsion; neutral filters for supplementary control of exposures; and polarizing filters. Polarizers may be used in photography for the control of reflections, for exposure and contrast control of certain surfaces or areas in a scene without affecting the other areas or surfaces.

Among the many uses of polarizers which are of interest in photography is their application to photoelastic analysis. Another application is in the production of special effects in color and in black-and-white photography. Of particular interest is the application of polarizers and polarizing photomaterials to three-dimensional photography.

The paper discussed briefly the fundamental mathematics involved in the polarizing effect, with particular reference to crosses polarizers. The practical application of polarizers to photographic problems were demonstrated by motion pictures, slides, and laboratory devices such as the polariscope.

Roy Boomer in TESMA Post

Roy Boomer has been named secretary-treasurer of the Theatre Equipment and Supply Manufacturers Association, it is announced by Oscar Neu, president of the organization. Boomer, who has been identified with the theatre supply field for the past thirty-five years, will devote his full time to the post.

Boomer will maintain the TESMA offices at 4356 Washington Boulevard, Chicago, and a cordial invitation has been issued to the theatre manufacturing and supply field to avail itself of the TESMA facilities.

N. Y. Cashiers Set by I. A.

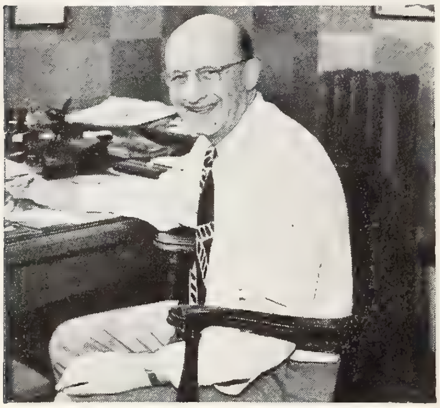
First union contracts covering theatre cashiers in the N. Y. City Metropolitan area has been signed by RKO and I. A. Local B-52. Pact, affecting 125 cashiers and retroactive to Sept. 1, 1945, provides for a 40-hour week, time and one-half for overtime, beginners' pay of $25 weekly, with a scale of $32 after three years employment; elimination of split shifts, two weeks vacation with pay, paid sick leaves and a closed shop. Cashier-secretaries will get a minimum of $27 and a maximum of $35 after three years.

Dividend payments by picture companies hit a booming total of $2,400,000 for the first two months of this year, according to figures released by the Department of Commerce. Major part of this comparatively high dividend record was accounted for by a large Warners declaration in January. The two-month total in 1945 was only $661,000.

February dividend payments this year actually declined from those for last year—$132,000 compared with $368,000. January payment total this year was $2,268,000 compared with $293,000 last year.

$100 Bond, Zipper Changeovers Offered by Larry Strong

There's a $100 Victory Bond and a brand, spanking-new pair of 1946 Strong Zipper Changeovers awaiting a projectionist at the Essannay plant in Chicago. These items—representing a cash value of $186.25—will go to him who is today



Essannay's Larry Strong.

using the *oldest pair* of Strong "Zippers" still in service.

The occasion of the offer is the observance of Larry Strong's 26th year of changeover-building. Reason for the competition is to demonstrate the year-in, year-out, trouble-free performance of motion picture projection accessories, and the care given his equipment by the average projectionist.

Larry asks that projectionists who are using change-overs of his early manufacture write him a short history of the units, including date of purchase, type of projector equipment, estimated number of projection hours used, service record on the changeover and the degree of its present operating efficiency. Also any unusual incidents in connection with projectionist, theatre or projection equipment during the period the Strong unit has been in operation.

Bond and new changeovers will be awarded to the projectionist whose Strong changeovers are the oldest and have the best record of performance. In case of a tie, duplicate awards will be made. Entries are to be mailed to Larry Strong, Essannay Electric Mfg. Co., 1438 N. Clark Ct., Chicago 10, Ill. Competition closes June 15. Awards will be announced July 5th.

Mark 'Talkies' 20th Anniversary By 4-Month Display Program

A four-month program of activities to commemorate the 20th anniversary of the commercial introduction of talking motion pictures is to be sponsored internationally by Warner Brothers Pictures, Inc., the American Telephone and Telegraph Co., Bell Telephone Laboratories, Eastman Kodak Company, the RCA-Victor Corp., Thomas A. Edison, Inc., and the Society of Motion Picture Engineers.

The Warners, who saw possibilities in "pictures that talk" when others scoffed at the idea as a passing novelty, sounded the death-knell of the silent picture on Aug. 6, 1926, with the presentation of "Don Juan," the first picture with a "fully synchronized and recorded musical score." John Barrymore, the star, and others of the cast were inaudible, however.

But on a surrounding program of short subjects opera and concert performers sang and played, the sound being played back from disks synchronized with the pictorial imagery. It was not until two years later that the first all-talking picture, "Lights of New York," was introduced by the Warners.

Early Equipment Displays Set

As part of the activities, an exhibition of equipment used in the production of the early talkies will be held in N. Y. city at the Museum of Modern Art and still-picture displays will be arranged in public libraries and in department-store windows. To climax the program on Aug. 6, there will be showings in 35 key cities of "Don Juan" along with a new musical film. Similar programs will be carried out in Canada, England, South America and "wherever in Europe American motion pictures are now being shown."

Contributions to the expansion of culture and education made possible through the sound motion picture also will be noted through special tie-ups now being made with educators, it was stated.

New GPE Research Lab Vital Progress Aid

Embarking on a comprehensive research and experimentation program, General Precision Equipment Corp. is now operating an ultra-modern laboratory at Pleasantville, N. Y., in a 67-acre area that formerly constituted part of the Hiram Manville (asbestos) estate. The rural setting belies the excellent laboratory facilities provided by intelligent planning in transforming a residence into an ideal workshop.

General Precision being the parent of 13 subsidiary companies, the majority of which are very actively engaged in the manufacture of motion picture equipment, the work done at the new research center is expected to be reflected in greatly improved equipment and advanced techniques.

Two major objectives of the laboratory are the coordination of research on government projects currently in hand and the centralization of all experimental work having a bearing on the interests of General's subsidiaries. All phases of the

View of main building of General Precision new research laboratory.

16-mm and 35-mm film fields will be explored, as will various phases of the electronic art, including television. The technical staff will number about 100 when the lab gets rolling along in high gear.

Director of the lab is Dr. Raymond L. Garman; while Herbert Barnett is coordinator of research. These two men and Robert T. Rinear, vice-president of General, will constitute the steering committee which will direct all lab activities.

Automatic Healing Condenser

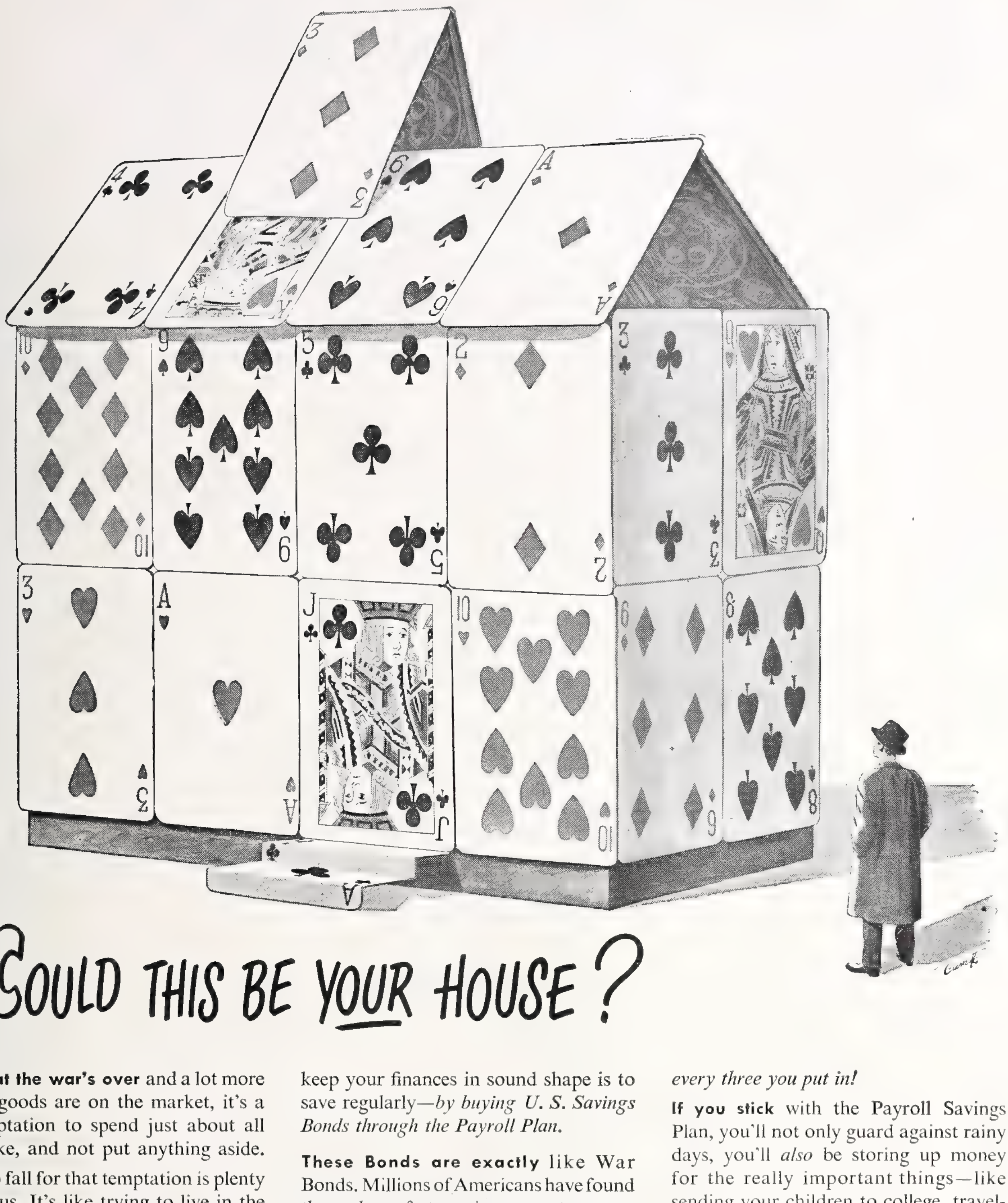
An ingenious German machine which may revolutionize the manufacture of condensers for electrical and electronic equipment is now en route to the U. S. and upon arrival will be available for inspection by American manufacturers. It is estimated that any present maker of fixed paper condensers could adopt the new process with an additional capital outlay of $25,000.

In this German fixed paper condenser the usual metal foil is replaced by a very thin, vaporized zinc coating, applied directly to the paper dielectric. More than 50 million such condensers for both A.C. and D.C. circuits were produced during the war.

Automatic Healing Feature

One great advantage of this type of condenser is that it heals automatically after an electrical breakdown, so that an adequate insulating margin is again established. Numerous breakdowns may occur before the effective value of the condenser is reduced below the workable limit. Because of this, metallized paper capacitators may be operated at from 20 to 50 percent higher voltages than is possible with paper and foil capacitators.

The metallized paper capacitators are about 40 percent smaller than the paper and foil type, and it is believed that production costs will be about 20 percent less. The process is covered by U. S. Patent 2,244,090, in the custody of the Alien Property Custodian.



INTERNATIONAL PROJECTIONIST

JUNE 1946

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HENRY B. SELLWOOD, *Editor*

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MONTHLY CHAT

THE rapid spread of interest in the electronic art is due in large part to the Army experience and training of many young men, to the current ballyhoo anent television "just around the corner," and to the liberal provisions for education incorporated in the G. I. Bill of Rights. Which is all to the good, of course.

Not slow to take advantage of this situation were scores of promoters of "schools" for this, that and the other subject, the main reliance for a steady income for which was placed on veterans' educational allowances. So many schools were opened, in fact, that Uncle Sam was forced to employ a large staff of field investigators to insure that the curricula approximated minimum standards.

As a case in point, through the ozone over the Metropolitan New York area these days (and elsewhere, we assume) is being wafted via radio spot announcements an enticing word-picture of the glories of the electronic age, participation in which may be assured if only one attends, for example, the XYZ School. No more aggressive campaign of selling "education" has hove into view since the infant days of Dr. Eliot's Five-Foot Shelf or, more pertinent in this space, the introduction of sound pictures.

The impressionable and highly susceptible recent member of the Armed Forces, understandably worried about his future, is enticed to spend his Government educational allowance to fit himself for a "career" in *radio broadcasting*, in *television*, and in *sound motion picture production and projection*. "Be a part of this great, new, glorious show business."

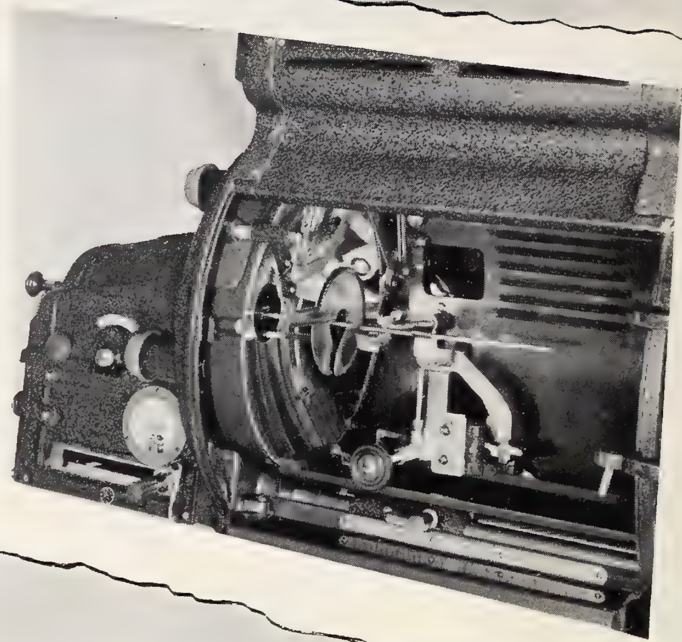
Now, the purpose of this little essay is not to record a blanket condemnation of these various educational enterprises. In fact, I. P. has stuck an inquisitive snout into the atmosphere surrounding a half dozen such schools, and it has been agreeably surprised to learn that the curricula in several such institutions were rather much on the O. K. side.

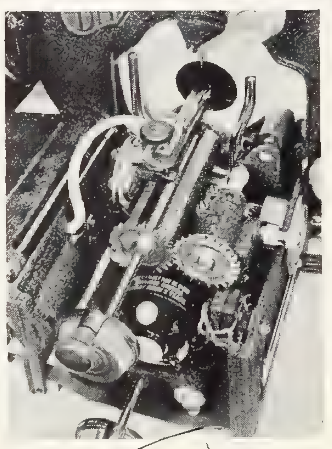
The implications of this situation in terms of the continuing security of the organized amusement crafts is so obvious as to hardly require even these few words of warning. Let us never forget that many of these youngsters now being invited to "learn for free" (the sum and substance of the G. I. bill) have the advantage of a good basic education, often extending through four years of college, in addition to intensive training in and *actual experience in using under pressure* a wide assortment of electronic devices.

The answer is obvious. The organized craft, to deserve its continuing security, must earn it. Not a few craft units have already instituted and are carrying on intensive and extensive educational programs. But the number is comparatively small. Let the sluggards take warning, even to the extent of an official International ukase of a compulsory character.

Bemoaning this situation or its probable results will not suffice; it must be met head-on.

Inside story of the BRENKERT ENARC LAMP





IMPROVED DESIGN and unit construction are features of Brenkert Enarc Lamps that mean work-saving maintenance and service . . . long mechanism life . . . uniform and brilliant screen illumination.

Negative carbon jaw assembly and motor and gear case assembly are separate, independent units. All units are quickly removed and replaced for cleaning and service without disturbing the accuracy of alignment.

Full opening doors on both sides of the lamphouse swing out of the way in a horizontal position, are quickly detachable, for work-saving convenience.

Controls for adjusting reflector, carbon alignment, motor speed and other arc-lamp controls are all conveniently placed for ease of adjustment, from any position on the operating side. No controls "stick out" where they might be accidently jarred or moved.

All controlling mechanism is mounted in the low-temperature chamber on back of the lamphouse, away from carbon ash and heat, and is completely exposed when the cover is open.

The entire negative carbon assembly slides backwards outside the lamphouse. The carbon can be adjusted *behind* the reflector . . . without difficulty. . . without danger to the reflector.

WRITE FOR ADDITIONAL INFORMATION

These and many other Enarc advantages were *engineered* to simplify operation, make maintenance easier and prolong the efficient service of this modern, work-saving projection lamp. Write *today* to Theatre Equipment Department, Dept. 43-F, RCA, Camden, N. J., for additional information.

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INTERNATIONAL PROJECTIONIST

VOLUME XXI JUNE, 1946 NUMBER 6

Switzer Electronic Arc Control

By *GEORGE W. SWITZER*

MEMBER, I.A. LOCAL UNION 551

CONSIDERING the rapid development of the electronic art, it is astonishing that the motion picture industry has not applied the fruits of this art to the solution of one of the most pressing problems of motion picture projection—accurate control of the carbon arc. The film industry still is utilizing an antiquated hit-or-miss method of arc control.

Numerous non-technical people have asked the writer why it is that during a show the picture is alternately light or dark. These laymen know that something is amiss in the projection process, but they don't know just what it is. At this point Mr. Projectionist usually takes it on the chin for being remiss in his duties.

The writer maintains that it is impossible for even the most experienced and conscientious projectionist to maintain a proper arc gap with existing methods of arc control. Even if one were to essay the job of watching the arc constantly (which one can't) efficient arc control would be impossible of attainment. The extremely slight variation in voltage or in carbon content (the core) which suffice to induce variable screen light is not, the writer holds, susceptible to accurate control by even the best efforts of any human.

To maintain the arc gap within that degree of tolerance essential for a perfect screen image—namely, .01 to .02 of an inch—requires by-passing the human element and substituting therefor a control which, without any attention from the projectionist, does the job simply, efficiently and unfailingly. Such a control has been invented and patented by the writer, and was described in these pages several years ago.[1] This present article will detail certain improvements which have been effected recently in this unit.

Recent development work has centered on simplification: a single tube using only the arc voltage for its plate supply, and only one control to be set and thereafter handle any change in line voltage and at the same time maintain the arc gap within .02 of an inch of the desired length without any attention by the projectionist.

Simplicity Attained

The writer feels that these objectives have been attained, plus a visible means for adjusting the controls and thus eliminating all guesswork. Reference to the accompanying diagram will, it is felt, substantiate these assertions.

Figure 1, the diagram, shows No. 1 as a variable resistor across the arc, the purpose of which is to adjust the control. This is shown also in Fig. 2 directly under the milliameter. Returning to Fig. 1, Nos. 2 and 3 are two fixed resistors hooked in series across the arc and in parallel with resistor Nos. 1 and 6, this hookup serving to drop the voltage fed to the screen grid of the tube, No. 4.

Number 5 is a fixed resistor used to supply the negative voltage for the tube. No. 6 is a fixed resistor in series with variable resistor No. 1, the purpose of the former being to prevent the entire arc voltage from being applied to the grid of the tube.

Number 7 is a filament transformer. It will be noticed that the cathode of tube No. 4 is attached to one side of the filament winding transformer, No. 7; the other side goes to negative or ground, the reason for this being to put an alter-

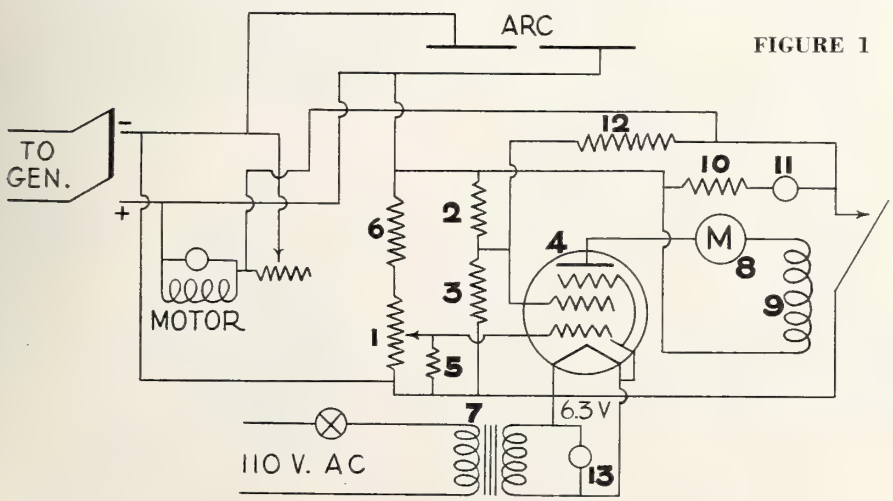

FIGURE 1

[1] "An Electronic Arc Control," by G. W. Switzer; I. P. for Jan., 1940, p. 7.

nating current on the plate of the tube. No. 8 is a milliameter in the plate circuit of tube No. 4, showing the plate current and also serving as a visible means for adjusting the control.

Also in the plate circuit of tube No. 4 is a sensitive relay, No. 9, which is used to vary the speed of the arc lamp motor. This specially-designed relay is made by the Sigma Instrument Co., since not just any sensitive relay will do the job. Also, the tube used is specially designed to work on low voltage.

Number 10 is a fixed resistor; while No. 11 is a 6.8-volt pilot lamp which indicates when the control is in operation. This lamp may be seen under the milliameter in Fig. 3.

Number 12 is a fixed resistor attached to the movable contact of relay No. 9, the other end of which is attached to the center of resistor Nos. 2 and 3 and also to the screen grid of the tube, No. 4. The reason for this is that when the relay closes resistor No. 12 will be put in parallel with resistor No. 3 and will change the latter's resistance, because, as we know, two resistances in parallel result in decreased resistance.

For example, if two 1000-ohm resistors were placed in parallel, we should have a value of 500 ohms. Thus it is that No. 12 acts as a variable resistor in the screen grid circuit of the tube and causes the voltage on the screen to become variable according to how hard and how fast the armature of the relay is pulled in.

Now, this will cause the plate current to vary; also, the contact points can never be completely closed, because when this occurs resistor No. 12 will be grounded and thus occasion less voltage on the screen grid. This will drop the plate current below the point necessary to pull in the armature, thus leaving the arm open.

FIGURE 2. ***Inside view of control showing tube, relay back of meter and shunt resistor for latter. Left, a.c. connector; right, lamp connector.***

When this happens the grid voltage will rise again and cause the plate current to rise and pull in the armature. This will happen at the rate at which the voltage is changing at the arc, for the reason that we are applying part of the arc voltage to the control grid of the tube.

Setting Up Control

We are now ready to set up the control on the arc lamp. The terminal marked "motor" goes to the motor side of the series resistor of the motor circuit. This extra resistor is required on most arc lamps, on the negative side of the line, because most of the motors on present-day lamps are shunt-wound.

We now turn the lamp's motor control so that the motor is running at full speed; putting the other resistor in series with the motor permits controlling the speed. We then set this resistor so that the motor is just turning over, after which we plug in on the A.C. line to obtain filament voltage. The pilot light indicating that A.C. is "on" is shown in the lower left-hand corner of Fig. 3. Now we are ready to go.

The proper way to strike the Suprex arc is to first bring the carbons together, then close the main switch, and then separate the carbons. This is done so as not to put the entire supply voltage across the control of the motor. There have been cases where the motor has burned out when the main switch was closed without the carbons being frozen, especially where 110 volts D.C. is taken from a power company line. Arc lamp motors are rated at about 40 volts, and closing the switch before freezing the carbons puts 110 volts across the motor.

Once the arc is burning and adjusted at the proper gap, we advance the control mechanism until the pilot light starts to flicker. The meter will show about 1½ mils, the adjustment on the relays being set so that it requires that amount of current to pull in the armatures. At this point the control takes over and goes to work.

In establishing the control the negative voltage placed on the control grid of the tube by resistor No. 5 is set a fraction of a volt positive. As the carbon burns back the voltage will rise and the increased plate current will cause the armature to be pulled in faster. This in turn cuts the series resistor out of the circuit more often, thus making the motor run faster. In this way the speed of the motor is matched with the burning rate of the carbons and maintains the arc gap at precisely the proper distance.

Assume, now, that the supply voltage goes up: this will occasion an increase in arc voltage and in the amperage, resulting in a rise in plate current and a consequent faster vibration of the armature of the relay, thereby speeding up the motor. The reverse is true should the voltage go down: the plate current will drop, causing the armature to vibrate more slowly and thereby slowing down the motor.

FIGURE 3. ***Front view of control: at top is 0 to 5 ma. meter; pilot light that shows when arc is burning; control adjustment knob. Left, pilot light which registers when control is on; right, a.c. switch.***

Voltage Variation Harmless

The carbons can never freeze when this control is operating, because the instant the carbons are brought too close together the negative voltage will increase through resistor No. 5. Then the positive voltage we are applying to the grid of the tube will cut off the plate current and allow the relay contact points to remain open until the carbons burn back and the positive voltage again overcomes the negative voltage on the grid.

The writer has used this control for more than four years and it works perfectly. The supply voltage has been altered as much as 10 volts up or down from the original setting without affecting the arc gap. This is a considerably greater voltage swing than is usually encountered. In fact, so smoothly does this control work that when a 5000-ohm-per-volt voltmeter is placed across the arc the needle thereof will hardly be actuated.

This control may be attached to any arc lamp and will effect a 100% improvement in feed control. It is as far ahead of existing controls as are the latter ahead of the old hand-feed types. We are still feeding by hand, in a manner of speaking, as we are always adjusting the arc.

With this control one merely strikes the arc and can then run through a 20-minute reel without having to again touch the feed.

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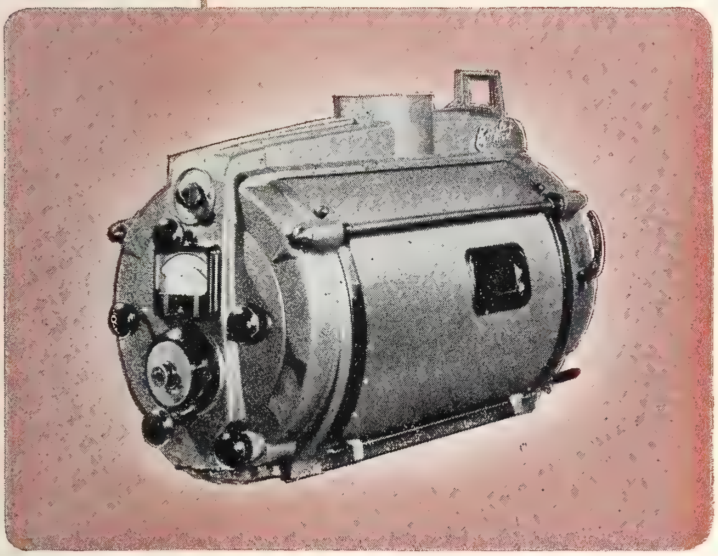

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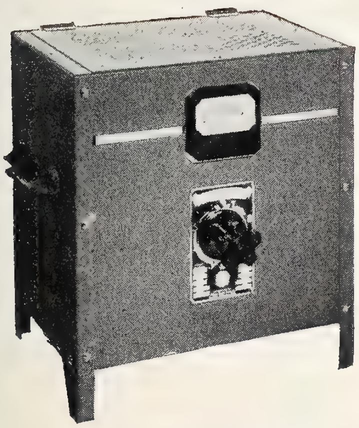

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"There's a Branch Near You"

Illusion of Depth in Motion Pictures†

By *HOWARD T. SOUTHER*
20TH CENTURY-FOX FILM CORP.

Motion pictures are not realizable as such until they are perceived by the brain through the eye. The accompanying article describes the manner in which the eye operates, particularly those functions having to do with perceiving objects as solids. The intelligent employment of motion picture taking equipment now in use, in making it conform to the requirements of the eye, can result in an important contribution to three-dimensional perception from the screen. Some 15 aids in promoting the illusion of depth are cited.

LEONARDO DA VINCI said that pictures were the result of "giving corporeal shape to the three dimensions on a flat surface." In the execution of his masterpieces, Leonardo the *artist* used Leonardo the *scientist* to fix his design, to project his true perspectives, to mix his colors, and to imprison light like Ariel in his web. This paper presumes to deal with the methods by which the three-dimensional illusion is evoked by calling attention to some 15 contributing factors.

But before going further, it is well that we understand that any pictorial effect is not realizable as such until perceived by the brain through the eye. In a simple and general way, the camera, projector, and associated equipment serve as a *delay mechanism* for the presentation to an audience of an occurrence which it is desired that they should see. We must keep in mind at all times that the eye and its peculiarities of perception should govern the steps by which this delay is accomplished.

Illusion of 3 Dimensions

Two broad corrections in lighting treatment are needed to achieve this delay. The first is a considerable compression of the range of light intensities falling on the subject. This is necessary in order that the exposure limits of the camera may be met. These are much less than those of the eye and generally call for an increase in the normal amount of light present.

Second, a correction for color is necessary. The eye and the film are not linear with respect to each other. For instance, yellow affects the eye more violently than the film; blue affects the film more violently than the eye. There are many other differences which call for compensation. We shall take up these points of variance more completely later.

One of the aims of motion picture presentation is to achieve the illusion of reality. Optically speaking, we must duplicate wherever possible in the minutest detail the actual experience of vision. Paradoxically, the requirements of perfection should not be too strongly emphasized. The human being is capable of considerable phychological adjustment to his environment in general; in this case, to the screen in particular.

The screen portrays its subjects many times oversize. We all realize that there is an easy adjustment to this seeming gigantism. There is also the adjustment which permits comfortable observation from the unnatural angle of the viewer.

In viewing a motion picture, the eye observes the scene in only two planes actually. By employing the proper technique, an illusion of three dimensions may be evoked. The illusion of three dimensions is built up upon the screen in a number of different ways. The following methods are employed universally at present:

FIGURE 2

Cast Shadows.

The Shape of Contours. We view in Fig. 1*A* the outline of a vase. The drawing means to suggest merely the feeling of an enclosure separated from its background by only a line. *Overlap.* In Fig. 1*B* we observe a slight increase in the feeling of form. The outlines of the 2 vases complement each other by virtue of the overlapped position.

Cast Shadows. The cast shadows of the two vases, in Fig. 2, on the background and the shadow of the first vase on the second have contributed tremendously to the feeling of form. Note also

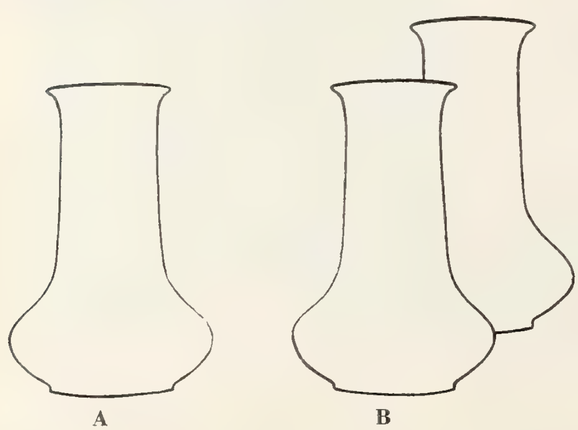

FIGURE 1

(A) The shape of contours;

(B) Overlap.

† J. Soc. Mot. Pict. Eng., April, 1946.

FIGURE 3
A striking example of perspective in photography and in viewing.

that the *shape* of the shadows has a contributing effect. Interest increases. Observe the contrast of light and shade. As the shadows are lightened the beneficial effect decreases. Heavy contrast results in more powerful delineation and perception of rounded form.

Perspective. The simulation of an actual viewpoint and the normal decrease in size because of distance have resulted in an increased effect, seen in Fig. 3. We are impressed psychologically by the duplication of an effect observed in everyday life.

Reflections. The shape and position of the reflection of the vase in the water below in Fig. 4 is something we would expect in normal existence. This is another duplication of the actual which increases interest and illusion.

Elevation and Light Reflections. In Fig. 5 the form of the vase has changed in shape because of the changed viewpoint. The phenomenon of foreshortening is experienced in graphic form. The tempering of the shadow by reflected light produces another simulation of reality. Daily experience again repeats in this figure.

All of these phenomena help in the three-dimensional illusion to a marked degree. The most important aid to this illusion. none the less, would be one which we miss in motion pictures almost without exception; that is, the function of the eyes in a stereoscopic manner. A more complete understanding of this important function of the eye may be achieved if we engage in a digression on the phenomenon of vision.

Definition of Light

Sight may be termed the perception by the brain through the eye of varying intensities of wave-lengths of light, radiated or reflected from a substance or object. Radiation may take place from generation within the object, in which case it incandesces, or glows, or by reflection of light by an object from the original source. Varying intensities of reflection from portions of the object impinge themselves upon the retina of the eye, and cause the object to assume form in our brain.

The sensitivity of the eye to different amounts of light can be measured. In the same manner, the sensitivity to various degrees of light on motion picture films can also be measured. However. the human eye is a wonderful device. It is much more sensitive in ordinary ways than the film.

The eye can detect changes of light of one in a million. The camera cannot. The ability of the eye to define an object is infinitely more acute. When we see a motion picture we must look through the eye of the camera. Whereas the retina of the eye consists of microscopic cells over 8.000.000 in number to the square inch, the finite granular structure of the film and the focusing limits of the camera decrease the definition of the object whose reflected light has caused an exposure upon its surface.

This phenomenon results in a distortion of the perceived image. The sensitivity of the film to color does not at present correspond with that of the eye. This results in a further distortion.

The knowledge of the manner in which these distortions take place, and in what degree, are important in our work. Distortions necessarily need not be bad. If they are controlled they can be very useful and may contribute materially to the artistic effect of a scene.

A paper flower may be distorted so as to appear more beautiful than a real one by proper light and a camera. The converse is also true. A real flower may be distorted by bad lighting and camera operation so as to appear like a paper one. The difference in achieving the desired effect and the opposite bad effect lies in the proper use by the various technical departments of their equipment.

Analogue of Camera and Eye

The camera and the eye partake of a number of mutual properties. The first of these is the physical one of construction. Fig. 6 shows that both the camera and the eye possess lenses which focus or gather the light rays and concentrate them upon the desired spot. In the eye this spot is the fovea of the retina. In the camera it is the film.

If the eye and the camera reacted in the same manner in every way, our problems would be simplified. But it is the difference between the eye and the camera which concerns us. The operations and adjustments necessary to make the camera react like the eye, or in any manner which we may desire, are the reasons for the further study on this subject.

The higher vertebrates are able to con-

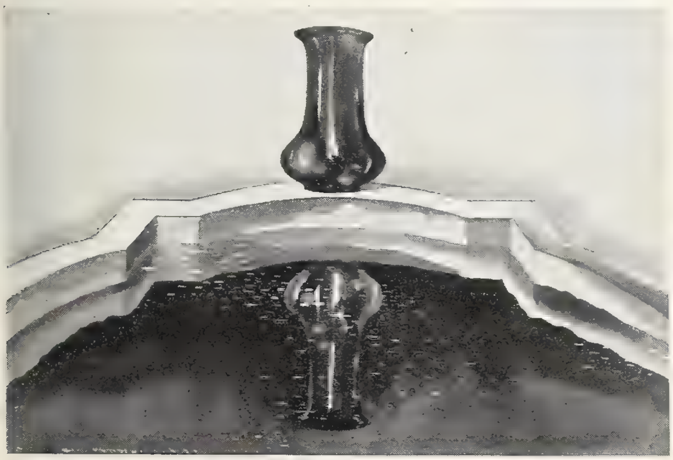

FIGURE 4. ***Reflections.***

FIGURE 5. ***Elevation and light reflections.***

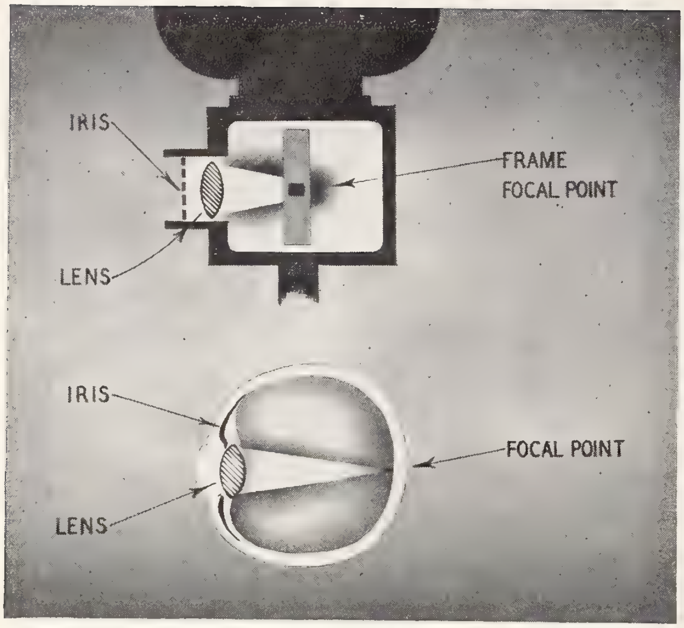

FIGURE 6

The analogue of the camera and the eye, showing how they partake of a number of mutual properties, including the important one of physical construction.

verge the axes of the eyes on nearer points. This enables the images of the point to coincide with the central spots of both retinas. This ability of the eye, and others, is associated with the development of the higher faculties of the mind. The normal position of the human eyes is convergent or parallel, but it is possible also for the eyes to diverge.

The movement of the eyes is complex. When they move together to one side or the other, up or down in a vertical plane, there is no rotation of the optical axes, *i.e.*, no torsion. When the visual plane is elevated and the eyes move to the right, they rotate to the right. When they move to the left, they rotate to the left. When the visual plane is depressed and the eyes turn to the right, they rotate to the left, and vice versa.

We constantly evaluate these complex muscular stresses, and *through experience* we interpret size, shape, and distance of objects. We must believe from this that a baby newly born must *learn* to see in three planes. They learn how far to reach for an object through evaluating muscular stress in the eye, and through actually evaluating the physical effort required in comparison to reach for it with their arm.

Accommodation by the Eye

Objects at different distances cannot be seen clearly at the same time. However, by interpreting the eye movements as the point of sight is focused forward and backward, the intellect automatically appraises size, form, and the distance of each object. This is the result of the ability of the eyes to focus upon a particular object and the ability of the observer's mind to determine from focus, and from previous experience in viewing other objects, the approximate distance of the object viewed from the eyes. This is part of the factor of accommodation.

The combination of convergence and accommodation, carried out unconsciously and automatically, produces the major depth effect.

Norling[1] says that the fundamental problem in projecting three-dimensional pictures is that of "projecting a 'right eye' image which will reach the right eye, and projecting a 'left eye' image which will reach the left eye."

If we were to assume that each eye was capable of independent scanning in the human being, the necessity of a particular picture for the right eye and a particular picture for the left eye would be eliminated. We know that stereoscopic effects are achieved by the camera today occasionally in the monoptical manner.

The premise is proved further by medical research. Ives[2] says that the old-time stereopticon photos resulted in a strain on the part of the eyes when viewed for more than a short period of time. This would tend to prove the idea of independent, or monoptical scanning. This would tend to prove, also, that the two eyes, scanning point for point at the same time, are doing an unnatural thing when they observe views in a stereopticon which keep them from scanning independently.

The eyes constantly scan a scene being viewed. When we dolly a camera, or when we follow with our eyes the actor as he walks across the screen, we are increasing the feeling of three dimensions very materially by scanning. We are injecting artificially one of the stereoscopic effects of which the eyes are capable when viewing the object in real life.

Single Stereoscopic Vision vs. Double Stereoscopic Vision

Now, a great deal is not known of the exact manner in which the eye functions. Most authorities agree that stereoscopic vision implies binocular vision. But this point is open to question. If this were true, it would hold that animals, the axes of whose eyes are spaced 180 degrees apart, would have considerable difficulty in perceiving near objects because of the inability to converge.

The actions and acuity of a deer, for instance, as far as distance is concerned, would preclude such restriction. In this case, the animal would have no more advantage than the human in viewing the present motion picture with only those previously exposed aids to viewing depth. *This gives rise to the idea that distance can be realized very well monoptically.*

The writer is inclined to believe that those stereoscopic effects achieved at times accidentally on the screen have as their basis a *scanning* operation by the camera. In effect, the camera duplicates a normal function of the eyes.

This, if true, would tend to show that stereoscopic vision is not entirely, if at all, a matter of effect achieved binocularly. Among other things, it means that we have room for unlimited improvement in our work with present equipment. Perhaps our problems are largely concerned with the refinement of technique.

Suggestion plays a great role in the art of seeing. Always we must hold in mind that we see with our *brain* through the eye. What the mind believes, the eye will see. We may hide the method, and the eye will believe the result, however achieved.

It has been the writer's intention in the foregoing paragraphs to show that a knowledge of the biology and psychology of seeing are very important. The intelligent use of equipment in conforming to the requirements of the eye will result in a great step toward our goal —"*corporeal shape to the three dimensions on a flat surface.*"

[1] Norling, J. A.: "Three-Dimensional Motion Pictures," *J. Soc. Mot. Pict. Eng.*, XXXIII, 6 (Dec., 1939), p. 612.

[2] Ives, Charles E., Eastman Kodak Company.

[Note: A complementary article, "The Theory of Lighting for the Camera," by the same author, will be published in the next issue.—Ed.]

Neumade Products Expands Plant

Oscar F. Neu, president of Neumade Products Corp., has announced the recent purchase of factory buildings occupied by that company in Buffalo, N. Y. Adjacent property also has been acquired for a large factory addition as well as complete modernization of the present buildings. With the completion of this work, the plant capacity will have been doubled.

The expansion program has been declared necessary to supply the greatly increased demand for Neumade's line of 35-mm equipment which includes rewinders, film storage cabinets, projection room tables, projectionists' desks, reels, spotlights and carbon and film cans, and a similar line of products for 16-mm use. Neumade offices are at 427 West 42nd Street, New York City.

ON NEWSREEL assignments or production work, when lighting conditions are extremely poor, the natural choice is the high-speed Eastman Super-XX Negative Film, one of the family of Eastman Films, industry favorites for more than fifty years.

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EASTMAN SUPER-XX...when little light is available

A Crystal-Gazer At Work

NOTHING has occurred since the new W. U. concentrated-arc (zirconium) lamp was reported on in these columns * to necessitate any change in viewpoint anent the present applicability of this unit as a light source for motion picture projection. Nor does it appear likely that the next five years will witness any appreciable change in this situation.

One exhibitor publication did oppose the I. P. report, however, but its objection was based on "principle" rather than on any data stemming from a *comparison* of the W. U. lamp with existing light sources. Still, it is interesting to examine the basis for this complaint about I. P.'s purported lack of ethics.

The publication in question charged that I.P. rendered a "disservice" to the industry in that it presented a mass of "alleged technical facts to prove that the W. U. lamp has no future for us" and, further, used a "bludgeon of big scientific words" against a newcomer to the field.

I. P. also missed the sole point of importance about the W. U. lamp: that it is based on a "new principle—one never used before," continued the indictment, and such tactics, it is held, can only serve to deter Western Union and other companies from developing new products for the motion picture field.

Winding up its critique of the I. P. report, this exhibitor paper indulges itself in whimsical speculation concerning the many "possibilities" for altering and thus improving the W. U. lamp to a point where it could challenge the present supremacy of the carbon arc.

Let's look into this criticism of the I. P. report.

Fact, Not Fancy, Needed

First, I. P. never stated that the "new Western Union lamp has no future for us." It did state that the lamp in its *present stage* of development was unsuited for projection. Since the Western Union engineers who developed the lamp concur in this finding, we can't understand the reason for our colleague's bleat.

On the score of I. P.'s "alleged technical facts," our critic elected to challenge the I. P. report solely on the basis of publishing ethics, and neither he, nor anybody else, has yet adduced a *single technical fact* tending to disprove a line of the I. P. report. We can't burn "ethics" in lamphouses.

I. P.'s "big scientific words" was not "fancy-sounding language" but merely a tool of the trade of publishing a technical journal. Anyhow, for those few who possibly may not have understood our exact meaning, we explained the terms as we went along. Just another I. P. service.

It is charged that I. P. missed the sole point of importance about the W. U. lamp—that it is based on a "new principle." Well, so was the Mechau optical projector based on a new principle, as was the Philips mercury-vapor lamp, as are scores of devices and methods developed during the past five years, many of which have come to the attention of I. P. Conceivably the sun's rays can be harnessed for film projection. But neither can we burn "new principles" in lamphouses.

Now about this business of rendering a great "disservice to the industry" by discouraging Western Union and other companies from developing new products. We have every reason to believe, as a result of personal association, that Western Union has highly competent engineers and sufficient business acumen to know exactly what they have in this new zirconium lamp—what it is, what makes it tick, and what it will do, no less than what it will *not* do.

A Test of Sanity

This being so (and who will deny it?) is there any sane person who believes that a single negative report such as appeared in I. P. relative to the present applicability of the new lamp would deter an outfit like Western Union from the further technical development and commercial exploitation of so valuable a piece of property? Surely, this is expanding naivete to the point of imbecility.

Western Union knows precisely what it has in this new lamp; it knows exactly what is required of a light source for efficient projection work, and, we hazard the guess, it does not need suggestions from the trade-paper field as to future procedure.

Regarding "possible" future improvement in this new light source, I. P. wishes Western Union all the luck in the world. I. P. has ever been the champion of the new—and the *efficient*.

But meanwhile thousands of motion picture theatres must operate thousands of hours daily week after week. The product of crystal-gazing will never illuminate a motion picture screen—*now, today*.

When Western Union announces that it has improved its lamp to a point where it is considered suitable for projection, I. P. will reopen this topic. When our trade-paper critic adduces one —*just one*—technical fact tending to disprove I. P.'s opinion on the score of the *present, or near-future*, applicability of the W. U. lamp to projection, we'll consider that.

Incidentally, we note that our distraught colleague "serviced" *his* readers on the W. U. lamp story by running a 1-column by $2\frac{1}{2}''$ picture over a four-line caption, including the phrase "said to be."

Didn't he know?

In conclusion, let it be generally known that I. P. presumes to speak for nobody but I. P. Its reputation for reportorial integrity and accuracy was an industry by-word before our critical colleague's paper was founded. I. P. serves the industry best by serving its readers well.

* "The W.U. Concentrated-Arc Lamp": I.P. for April. 1946, p. 16.

I.A. Chicago Meet July 22 Set for 1000 Delegates

More than 1,000 delegates representing 900-odd local unions will be in attendance when the gavel falls signalizing the opening of the 38th Biennial Convention of the I.A.T.S.E. and M.P.M.O.U, to be held in the Stevens Hotel, Chicago, on June 22. This will be the third such meeting in Chicago, the two previous like sessions having been in 1894 and 1915.

In fact, it was in Chicago that the I. A.'s present title was adopted in 1915. the two previous designations having been limited to stage employes.

Although all locals in the Chicago area have been working diligently to provide for the comfort and entertainment of convention delegates, the convention arrangements committee stresses the fact that hotel accommodations are extremely scarce, necessitating prompt action by all designates.

Twenty-five locals have been chartered by the I. A. since the 1944 convention in St. Louis, including locals representing television studio employees, wardrobe attendants, studio publicists, and broadcast studio workers.

The preconvention meeting of the I. A. General Executive Board will be held at the Stevens Hotel on July 15 and will remain in continuous session until all business properly submitted is disposed of.

GERMAN MAGNETOPHONE

Further details on high frequency models of the German-developed Magnetophone, using magnetic tape for recording sound, are described in a report released by the Office of the Publication Board, U. S. Dept. of Commerce (PB-12659; photostat, $3; microfilm, 50 cents; 44 pages). Research and design information pertaining to the mechanical systems, electrical circuits, recording processes, and the recording tape are discussed in detail in the report. Photographs, wiring diagrams, and schematic and performance curves of some of the systems are included.

Television in the Movie Theatre?

By *LESTER B. ISAAC*

DIRECTOR, PROJECTION AND SOUND
LOEW'S THEATRES, INC.

Herewith the opinion of the technical director of one of America's largest and most important theatre circuits anent the possibility of television programs in movie theatres as at present constituted. The views expressed herein are those of the author and do not necessarily reflect the opinion of Loew's, Inc., or any of its officials.

AFTER much talk and probably some concern on the part of motion picture exhibitors as to how television will affect their theatres, I have come to the conclusion that it is about time that something was said to alleviate their fears. Merely as a novelty, television cannot bring patrons to the box-office. It must be entertainment comparable to that to which they have been so long accustomed.

For the past several years, I have made a careful investigation and study of the television situation, and it is my opinion that to which they have been so long will enjoy their universal popularity for many, many years to come. Yet there are many in the television field who will not agree with me, and to the contrary, even make claims that the new art will eventually replace the motion picture.

I think, however, it may be acknowledged that of all the claims that have been made to date regarding the practical possibility of television as a form of public entertainment, not one has developed as an accomplished fact. This would seem to indicate that while making full allowance for the need of progress and vision, certain elements of the television field are day-dreaming and much confused as to the future of television in the theatre.

The motion picture industry has had long practical experience in the entertainment field, and I am sure that those who have carefully studied this situation are not greatly alarmed. I do hope, however, that this article may offer some mental relief to those exhibitors who at the present time have fears regarding the many complications and heavy expense which will be entailed through the installation of television in their theatres.

Box-Office Appeal Requisite

Theory is necessary in engineering and medicine, but the exhibitor cannot use the public as guinea pigs. When the product reaches the theatre, it must have very definite box-office possibilities. On an average it must be profitable entertainment, for after all, the real boss of the motion picture industry is the man, woman or child who lays down the price of admission at the box-office. Even with such a phenomenon as television, we must be far-sighted and practical. In my opinion, what Barnum said about the credibility of the American public is no longer true today. The public shops for the best entertainment and for the most comfort.

First, let us assume that television projection room equipment is NOW available for theatre use. How could such programs be handled in a practical manner? Particularly those on-the-spot pickups? Certainly it would not be practical or desirable to break into our regularly scheduled motion picture film programs.

For example, a theatre screening of the main feature is scheduled for 12 noon—and at 12:50 P. M. you receive a phone call that a fire or flood is taking place in one of our large cities, and this will be telecast at 12:55 P. M. Now in order to bring this television program to your audience, the feature picture must be stopped, after running for 55 minutes, with 35 minutes more required for completion. Certainly no one, by any stretch of the imagination, can believe that theatre patrons will cheerfully put up with any such interruption of the show.

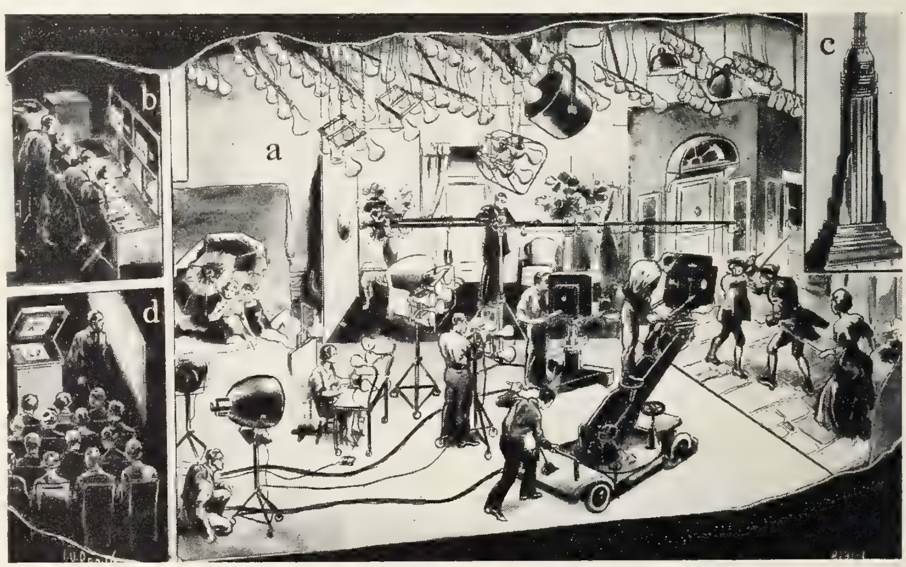
It is no doubt true, of course, that when television programs of national interest are prepared in advance, a schedule could be arranged to meet the requirements of such a telecast. But this telecast must be arranged for at a date which will allow the theatres to publicize the fact to their patrons. If, however, the telecast program is of wide national interest, then why should the public go to the theatre and pay admission, when such a telecast might be seen on their own home receivers?

Practical Tele Projector?

Since there has been wide talk about the likelihood of using television in the theatres at some comparatively immediate date, I think we must now seriously consider the fact that at the present time, so far as I know, there is no television projector available for practical use in motion picture theatres. I want to emphasize the words "practical use," as this will be dealt with later herein.

I concede that there are at least two so-called theatre television projectors—there may be more—but I have seen only

(Continued on page 26)



BEHIND THE TELEVISION SCENES AT NBC

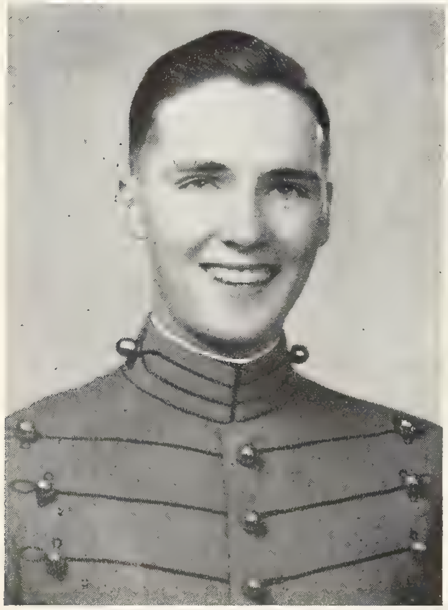
In the four main phases of television shown here you see (a) the studio in the RCA building where actors and technicians work under studio lights; (b) the master control room where engineers and directors monitor the sight and sound pickups, whence the electronic impulses speed by cable to the Empire State transmitter; (c) antenna atop the Empire State which broadcasts television programs over a 50-mile radius; and (d) combination receiver which reproduces sight and sound transmitted by video and audio carrier waves.

IN THE SPOTLIGHT

By HARRY SHERMAN

IN A recent letter to Congressman Gordon L. McDonough of the 15th District in California we deplored the lack of recognition given the back-stage employes for their part in bringing entertainment to our armed forces through the world during the war. Congressman McDonough at a recent House session praised these "unseen and unsung soldiers of the entertainment world." His remarks, published in the *Congressional Record* for May 21, are sufficiently interesting, we think, to warrant reprinting herein.

"Much has been said and a great amount of credit has been given to the radio, stage and screen actors and entertainers who traveled long distances, under many handicaps, to entertain our armed forces during World War II," declared Congressman McDonough. "Unfortunately, the men behind the scenes have been overlooked. I refer to the stagehands . . . and the whole crew that had to go along to make a show a success.



WEST POINT GRADUATE

We present to our readers Cadet Patrick J. O'Connor, son of John F. O'Connor of Chicago Local No. 110. Young O'Connor is a member of the 1946 graduating class of the United States Military Academy at West Point, N. Y. Congratulations and best wishes, Patrick, for a happy and successful career.

These men did not get the applause, they were not given citations, and little is known of the difficulties they had to overcome to 'set the stage' for the star so his show would be a success.

"Somebody had to set the lights and control them. Somebody had to put up and take down the scenery. Somebody had to pack and unpack all the gear to make the entertainers more effective. That somebody was the stagehand who was not eligible for military service but nevertheless left his home and family, travelled thousands of miles and met the same hardships cheerfully to see that our boys in the armed forces were properly entertained. When citations are handed out, they should not be overlooked. They are deserving and have won them just as much as the entertainers."

Well spoken, Congressman McDonough.

● Under the new wage contracts, recently successfully negotiated by business agent John Krebs, each member of Cincinnati L. U. 327 has been granted a $5 weekly increase based on a 36-hour week, plus vacation with pay. Members working in suburban houses will receive an additional $2.50 per week for the next three years.

● While visiting a number of local unions throughout the country on a recent extensive road trip, we learned that many of the union officials were dissatisfied with the wage scales in force at drive-in theatres. Wage scales are generally based on the price of admission, and although the admission price for the average drive-in theatre is about 65c per person, the minimum charge for an automobile admission is twice the amount, or $1.30, even if there be only one passenger in the car. Union officials contend that future wage scales for drive-in theatres should be based on the $1.30 admission price and not on the 65c rate. We think the boys have something here that warrants careful consideration in future negotiations.

● Bridgeport L. U. 277 did itself right proud at the shindig it threw for its members discharged from the armed forces. Reports reaching this department relate that Les Blakeslee did a swell job as chairman of the arrangements committee. The ex-service men thus honored are Mario Parelli, George Antoniak, Tom Colwell, Myron Levy, Arthur McLeod, Larry Pastore, Jr., Bill Towle, Harry Kaplan, John Musante, Frank Matera, Frank Gorman, Charles Parkas, Elwood Lavery, Robert Lewis, Arthur Fensore, Robert Hill, and Ralph Broderick. Quite a showing for a medium-sized local.

● Roy Ruben, financial secretary for Detroit L. U. 199, is spending a much-needed vacation visiting relatives on the West Coast.

● The sudden death of Johnny Pross, member of New York L. U. 306, who succumbed while working in the projection room of the Astor Theatre there, was a shock to his many friends in and out of the industry. Pross was well known to many of the older members of San Francisco L. U. 162, having worked under that local's jurisdiction way back in the days when Les Dolliver was its business agent. Johnny won national recognition as an expert on projector mechanisms.

He is survived by his widow and a son, John Pross, Jr., also a member of New York L. U. 306.

● Charlie Vencill, secretary of Los Angeles L. U. 150, visited New York last month to attend a convention of Union Labor Legionnaires, of which he is the national president. We spent some pleasant hours together "chewing the fat," as it were, and wound up the evening by attending a Local 306 midnight meeting. Charlie was introduced to the membership and was given a warm welcome.

● Now that the time is nearing when many union contracts will come up for renewal and negotiations will soon be getting under way, it might be well to give some serious thought to the question of double-time pay for Sundays and holidays and time-and-a-half for Saturdays.

Holidays are recognized at the box-office by increased admission prices, but this recognition stops where theatre employes are concerned. Why? Theatre tradition? Bunk! Does this theatrical

tradition demand that the projectionist, for example, spend his holidays at work away from his friends and family just for the fun of helping Mr. Exhibitor fill his box-office till? If this be theatre tradition, let us throw it in the ashcan and demand the same recognition accorded other organized crafts.

During the war Federal legislative and judiciary employes received an extra 10% in pay to compensate them for working on Saturdays, and recently the United States Senate and House Conferees agreed to continue this extra compensation.

As we stated so many times before, a holiday is just as important to a theatre employe as it is to a member of any other industry, and if he be willing to forego it, his employer should show his appreciation by proper remuneration.

● Earl V. Armstrong, former president of Toronto L. U. 173, resigned his position with Dominion Sound Equipments to take the post of projection supervisor for Gaumont-Kalee of Canada. Armstrong is no newcomer to the industry, having started his career in the projection field 'way back in 1910.

● The U. S. Labor Department has reported officially that the wartime "no strike" pledge by organized labor was "well kept." During the 44 months of war the man-days lost due to strikes amounted to only 11/100 of 1% of the time actually put in by the nation's workers, says this report. Further, nearly all the stoppages that did occur were "unauthorized" and "were quickly terminated." Scarcely any strikes were authorized by national or international unions, notes the report.

● The 25-30 Club testimonial dinner given last month in honor of Bert Sanford of Altec and Harold Rodner of Warner Bros. was the occasion for a great turnout by many prominent personages in the industry. It was a grand affair and we salute the Club's arrangements committee: well done, boys.

Honorary members Harold Williams and Bob Goldblatt made very generous contributions to the Club's treasury, the money to be used for whatever purposes the members elect. Donations were promptly made by the Club to various charitable institutions.

Among the Altec personnel present at the party were L. J. Patten, A. J. Rademacher, M. N. Wolf, G. M. Pinckney, John North, H. E. Fettig, Pete Hoey, and Ralph Kautzky (the latter being president of Associated Electronic Engineers).

Representing International Projector Corp. and National Theatre Supply were Arthur Meyer, Allen B. Smith, P. A. McGuire, Henry Heidegger, Rudy Kneuer, John Krulish, Jack Lindsley, James Frank, Jr., J. W. Servies, and Bill Nayfash. National Carbon Co was represented by Bill Kunzmann, Dave Joy and Paul Reis.

Next Month . . .

as a supplement to its July issue I. P. will publish a Convention Edition signalizing the I.A.'s second 50-year span of service to the entertainment world. This informative, authoritative edition will be distributed to all I. P. subscribers and to each Convention delegate. Watch for it.

Others present at the affair included Lester Isaac, projection supervisor, Loew's, Inc.; Harry Rubin, projection supervisor, Paramount Theatres; Milton Berkowitz, chief projectionist, Capitol Theatre; Charles Muller, chief projectionist, Radio City Music Hall; Herman Landeweher, manager, Capitol Theatre; Herman Gelber, president, New York L. U. 306, and the entire official family; Al Kaye, secretary of Hudson Co. (N. J.) L. U. 384; Harold Armstead, Boston L. U. 182; Russ Stewart, Columbus, Ohio, L. U. 386; Larry Strong, Chicago L. U. 110; Cecil R. Wood, Sr., New York L. U. 306; Nat Golden, chief of the motion picture division of the U. S. Dept. of Commerce, and a host of other projection personages.

● True bills charging two theatres with being unsanitary and vermin-infested were returned against the operators of the Russell and Washington Theatres in Maysville, Ky. We hope this is the beginning of a drive throughout the country to compel theatre owners to pay as much attention to the sanitary conditions of their theatres as they do to the expensive fronts and lobbies of their houses.

● Blacky Bordonaro, president of L. U. 444, New Kensington, Penna., will once more represent his local at the forthcoming I. A. Convention.

● Another one-man projection room fire. Harold Gill, projectionist at the Neu Theatre in Stapleton, Nebr., was alone in the projection room when two reels of film exploded. No, neither the equipment nor the projection room was damaged. What happened to Gill? Oh. he was rushed to the hospital suffering from severe burns and injuries sustained in trying to escape from the fire.

● Kentucky L. U. 163 has completed the second phase of its wage negotiations with the theatres in its jurisdiction. Class A and class B theatres have already been signed up, giving the projectionists in these houses salary increases plus vacations with pay. This is the first time in this local's history that the members have been granted paid vacations. The wage scale committee, headed by Harry Petty, president; A. A. Ansback, vice-president; Bob Hulett, secretary, and E. S. Clay, all of L. U. 163, is now working on negotiations for the suburban houses. We don't doubt that this committee will turn in an equally good report on these theatres. Incidentally, Petty is also president of the Kentucky Federation of Labor.

CHICAGO LOCAL RECEIVES U. S. TREASURY CITATION

Officers of Chicago Local 110, on behalf of the membership, accept an official commendation awarded the members for their splendid showings in the eight war loan drives. George T. Moore (extreme left), manager of the Labor Section of the U. S. Savings Bond Division of the Treasury Department, is shown presenting the citation to James J. Gorman, president of the local. Standing next to Moore is Chas. B. McNeill, member of the executive board; Gorman; Eugene Atkinson, business manager, and Frank Galluzzo, vice-president.

Basic Radio and Television Course

By *M. BERINSKY, E.E.*

MEMBER, INSTITUTE OF RADIO ENGINEERS

XXIV—RECEIVING SYSTEMS

THE crystal detector which was described in the preceding article had many limitations. For ordinary radio work the vacuum tube is superior to the crystal as a detector. Fig. 1 shows a circuit of a vacuum tube being used as a detector. The circuit, called a grid-leak detector, is of the square-law type, meaning that it was designed to handle weak signals.

The resistor in the grid circuit is known as a grid-leak and may be from 1 to 5 megohms in value. The condenser across this resistor is approximately 250 micro-microfarads (mmf.) and the tuning condenser is usually 365 mmf. for the broadcast band. The grid-leak and condenser form an impedance similar to the load resistor and filter condenser in a diode rectifier. The grid acts like a diode plate, and rectification takes place between the grid and cathode.

The incoming signal is applied across the primary of the antenna coil. By transformer action it is impressed in series with the secondary and the 365 mmf. tuning condenser. Grid current flows during the positive half-cycles of signal voltage. The rectified current produces a varying voltage across the grid-leak, and the 250 mmf. grid condenser charges to the peaks of this voltage, resulting in the application of an audio signal in the grid circuit. The audio is then boosted by the amplifying properties of the tube.

A radio frequency (rf) filter is placed in the place circuit of the tube to keep radio frequencies out of the phones. This filter is usually omitted because the phones have a high reactance to rf. The variable resistor in series with the filaments maintains the proper filament voltage on the tube and should be included if the filament is operated from a storage battery. This circuit is superior to the crystal detector because it is more sensitive to weak signals due to the amplifying properties of the tube.

If a strong signal is applied to this type of detector, the tube will be biased to too high a negative voltage. This voltage will appear across the grid-leak and will be applied as grid bias. The plate current will be greatly reduced or cut off and the tube will block, resulting in distortion.

The circuit may be designed to handle large signals and thus act as a power detector. In order to convert the circuit of Fig. 1 to a power detector it is necessary to reduce the value of grid-leak resistance to approximately 100,000 ohms. The negative voltage developed across the grid-leak resistance under these conditions will be smaller due to the reduced grid resistance, and the tube will not be biased to cut-off, and, therefore, will not block so easily. Under these operating conditions the circuit will lose some of its sensitivity to weak signals.

The grid-leak power detector has the disadvantage that the maximum carrier voltage that can be handled is about 40% of the peak alternating voltage that the same tube could handle when operating as a Class A audio amplifier; and the output voltage obtainable without excessive distortion is likewise about 40% of the voltage obtainable from the same tube acting as an audio amplifier. These limitations are due mainly to the fact that with applied signals larger than this, plate rectification has an effect on the peaks of the modulated wave, and combines with the effect of grid rectification to flatten the positive peaks.

The Regenerative Detector

The regenerative detector was invented by E. H. Armstrong, the American scientist, who holds many basic radio circuit patents. Such a circuit is shown in Fig. 2. It can be seen that this circuit is similar to that of Fig. 1, except that the filter network in the plate circuit has been omitted and some of the energy in the plate circuit is coupled back to the input circuit by means of a coil known as a "tickler coil."

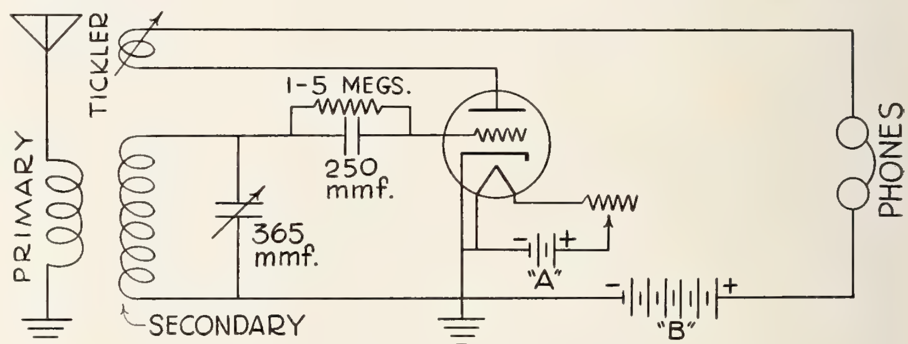


FIGURE 2. *Regenerative detector.*

Along with the rectified output signal, there is present in the output circuit some of the amplified signal currents. When these amplified signal currents that appear in the plate circuit are fed back into the input circuit so that they are in phase with the input signals, they will re-enforce the input signals and will help to overcome the resistive losses in the turned circuit. This will result in a tremendous increase in amplification and the efficiency of the entire circuit will increase several times.

It is important that the phase relations between the incoming signals and the signals which are fed back from the output to the input circuit be the same (as in an oscillator) in order for regeneration to take place. If all of the coils are wound in the same direction, the proper phase relations will be maintained when the tickler coil lead, which is connected to the plate, is wound adjacent to the

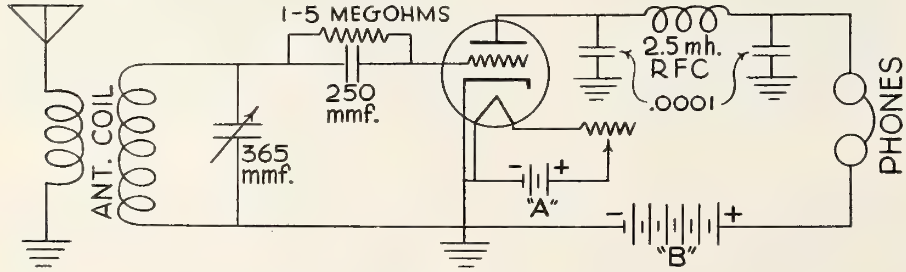


FIGURE 1. *Grid-leak square-law detector.*

secondary coil lead, which is connected to the grid.

When regeneration is carried as far as possible without going into oscillation, the resulting increase in amplitude is very great for extremely weak signals, and is less, although still large, for strong signals. The maximum possible regeneration without oscillation is called "critical regeneration."

Regeneration is an inexpensive means of increasing the radio-frequency amplification. However, it increases the selectivity excessively, requires critical adjustments that depend on the signal frequency, and introduces oscillations with consequent interference and whistles whenever the regeneration is accidently made excessive. Regenerative detectors have found little application since the development of satisfactory radio-frequency amplifiers.

Several methods for the control of regeneration to the critical point are possible. All of these methods control the amount of signal which is fed back from the output circuit to the input circuit.

One of the early control methods consisted of a variable tickler coil which was free to rotate inside of the secondary coil. This assembly was known as a three-circuit tuner and was very popular in its day. When the plane of the tickler coil was parallel to the plane of the secondary winding the maximum amount of feedback — hence, regeneration — would result; and when the planes were at right angles to each other very little feedback was obtained. Anyone who operated this type of receiver was able to adjust the amount of feedback by simply turning this coil.

The variable tickler coil was not a convenient arrangement, so other methods were evolved. Any method which will control the amount of feedback from the output to the input circuit can be used as a regeneration control.

Some methods which are in use are as follows: (1) a variable resistor connected across the tickler coil, the tickler being stationary. This resistor will draw away some current from the tickler coil, thereby decreasing the amount of feedback. (2) A variable condenser connected from the B+ side of the tickler coil to ground: the reactance of the condenser decreases as the capacitance is increased, thus shunting away some of the signal from the feedback circuit. (3) A variable resistor in series with the B+ which is applied to the plate of the tube: increasing this resistor will lower the gain of the tube and will reduce the amount of feedback. If a tetrode or pentode be used, this variable resistor may be inserted in series with the screen grid. In all of the methods enumerated the tickler coil is stationary.

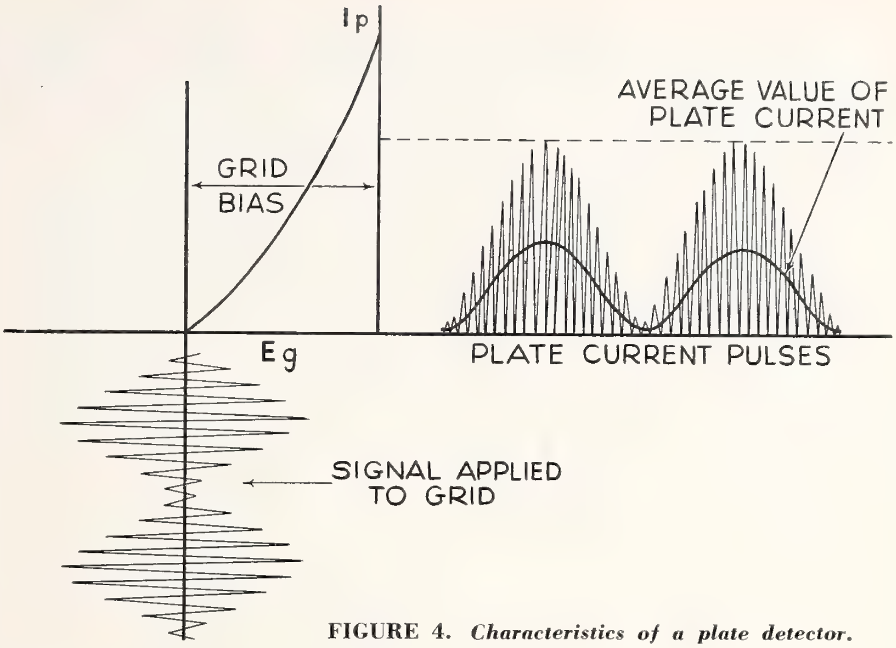


FIGURE 4. *Characteristics of a plate detector.*

MAY QUESTIONS AND ANSWERS

1. **(Q.) How are different stations tuned in?**
   (A.) By the resonant effects exhibited by the coil and condenser.
2. **(Q.) Why is a large amount of selectivity desired?**
   (A.) To facilitate the separation of adjacent stations.
3. **(Q.) Name two disadvantages of crystal detectors.**
   (A.) Crystals are delicate and unstable.

As an example of the amount of amplification possible with this type of circuit, the writer once constructed a one-tube, short-wave receiver using regeneration and was able to bring in stations from as far away as Australia.

When the regenerative detector goes into oscillation it acts like an Armstrong feedback oscillator and is capable of transmitting a signal. To guard against the transmission of these spurious signals (which is illegal) an amplifier is usually connected between the antenna and the detector. This amplifier not only provides additional amplification, but also serves to decouple the oscillating detector from the antenna, thus preventing the transmission of interfering signals.

The Plate Detector

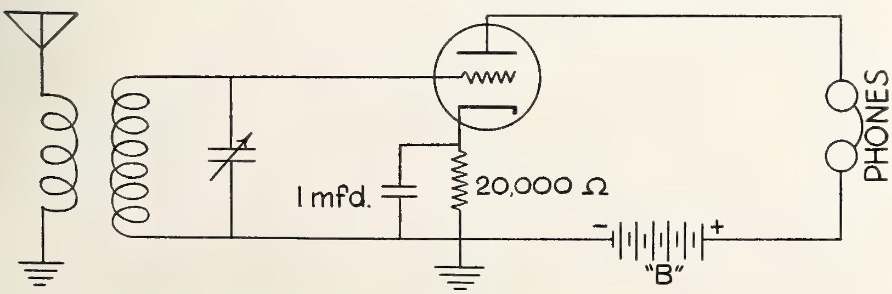
Another method for detecting a radio-frequency signal is by means of the plate detector also known as the anode detector and the biased detector. This circuit is shown in Fig. 3. In the grid-leak and regenerative types, detection took place in the grid circuit. In the plate type, detection takes place in the plate circuit.

In the circuit of Fig. 3 it will be noted that a grid-leak is not used. Instead a cathode resistor is used as a means for supplying grid bias. This resistor is large for a cathode circuit, but it is made so for a good reason.

We learned from previous articles that a diode tube acts as a rectifier. It is also possible to operate an amplifier tube as a rectifier. Such a method is used in the plate detector since rectification is a necessity for detection. In this circuit, an ordinary amplifier tube is biased approximately to cutoff. The cathode bias resistor is adjusted so that the bias will approximate cutoff with normal rated carrier voltage.

A radio-frequency signal voltage applied to the grid of such a tube will give pulses of plate current on the positive half cycles and no current on the negative half cycles, as shown in Fig. 4. The reason why current does not flow on the negative half cycles is due to the fact that the tube is biased to cutoff and a negative voltage merely drives the con-

FIGURE 3. *Plate detector.*



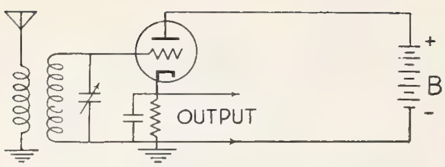


FIGURE 5. ***Infinite impedance detector.***

trol grid more negative, making the flow of plate current impossible.

On the positive half cycles the control grid is driven to a point which is less negative than cutoff, and plate current is allowed to flow. The average plate current which results on the positive half cycles of signal voltage is dependent upon the average amplitude of the applied signal, thus giving demodulation. This current develops an output voltage by being passed through an ordinary audio-coupling system.

The plate detector presents an infinite impedance to the tuned circuit to which it is connected. This is an advantage over the other types of detection which draw current from the signal voltage. Because of its high input resistance, the plate detector gives more output voltage than a diode detector in proportion to the applied signal.

The infinite input resistance of this type of detector does not adversely effect the Q of the tuned circuit as compared with other types of detectors. At the same time, plate detection has greater distortion, is more critical as to the range of signal strengths which give satisfactory operation, and can develop only a limited available output voltage without excessive distortion.

It is possible to obtain only about one-third as much output voltage from a given tube acting as a plate detector as when operating as a Class A audio amplifier. This circuit is widely used in tuned radio frequency (TRF) receivers.

Infinite Impedance Detector

This tpe of detector is shown in Fig. 5. When the signal voltage is applied, a rectified plate current flows and builds up a voltage across the output load impedance that is only slightly less than the amplitude of the modulation envelope. The end result is about the same as with diode detection, except that the input impedance is infinite. This leads to the same advantages that were discussed under the plate detector.

The maximum modulation-frequency voltage obtainable across the output without overloading is quite large, approaching half the plate-supply voltage.

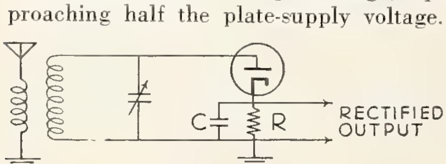


FIGURE 6. ***Diode detector.***

The bias on the infinite impedance detector is adjusted so that it operates close to cutoff when no signal is applied. If distortion is to be minimized, it is necessary that a fairly large signal voltage be applied to the detector.

The Diode Detector

The diode detector is the type most widely used at the present time (Fig. 6). The incoming signal is applied between the diode plate and the cathode. During the negative half cycles of incoming signal the tube will not conduct due to the fact that electrons cannot flow from plate to cathode within the tube. This means that the negative half cycles will not be present in the output circuit and rectification will result.

During the positive half cycles the tube will conduct and electrons will flow through the cathode circuit producing a voltage drop across the diode load resistor. This voltage will charge the condenser which is connected across the load resistor. This charging voltage is only slightly less than the peak voltage of the signal input.

During the negative half cycles the condenser discharges through the resistor and the charges are replenished during the positive half cycles.

The value of the condenser across the diode load resistor is usually about 100 mmf. It has a low reactance to the radio-frequency voltages and will bypass them to ground. At the audio frequencies the condenser will have a very high reactance and will not act as a shunt to ground. This means that the condenser will charge to the peaks of the modulation envelope and will reproduce the modulating voltage.

Diode detectors have many advantages. They are capable of working over a wide range of signal voltages with little distortion. The diode detector provides a very convenient means for obtaining automatic volume control voltage.

The efficiency of the diode detector decreases when the input signal is small. The diode draws current from the signal source and tends to load the inuput circuit. Because the efficiency of the diode detector falls off when the input signal is small, this type of detector is generally used in circuits which have a considerable amount of pre-amplification.

JUNE QUESTIONS

1. **What is the principal advantage of the grid-leak square law detector?**
2. **Give one disadvantage of the regenerative detector.**
3. **Why is the diode detector so widely used?**

The answers to these questions will appear in the next issue.

Foreign Movie Trade Outlook Good

Requirements abroad for sound recording and theatre equipment will provide a broad market for American-made products, according to E. S. Gregg, vice-president and general manager of Westrex Corp., who has just returned from an inspection trip in 17 countries in Europe and the Middle East. Visiting 30 studios and talking with many motion picture producers and theatre owners in each country, Mr. Gregg indicated that although severe restrictions on foreign exchange still exist in most countries, there were some signs of improvement, and this situation should be much better by the end of the year.

The constantly mounting export trade should reach its peak by mid-1947.

CPA Exempts Projection Units

Theatre equipment items, including projection and sound units, seats and other important adjuncts, are specifically exempted from the restrictions of the construction control order, CPA has ruled. Supplement 1 states that the following articles (among others) are "never" considered to be fixtures or mechanical equipment:

1. Projection and sound equipment; 2. Theatre seats; 3. Automatic fire protection sprinkler systems; 4. Power generating or transmitting equipment such as boilers, generators, and transformers (except where the primary purpose of the equipment is to provide electricity or steam for lighting or heating the building in which they are installed).

The What, How and Why of Frequency Modulation

Frequency Modulation (FM)—A method of radio broadcasting in which the broadcast waves change in length and their strength remains constant.

Amplitude Modulation (AM)—The present standard method of broadcasting, in which the broadcast waves change in strength but the wave-length remains unchanged.

What FM Does—Eliminates static, noise of electrical appliances and other disturbances that interfere with reception on AM radio receivers. It also permits reception of the entire range of sound audible to the human ear.

Where FM Operates—The Federal Communications Commission has assigned FM broadcasting to the extremely short wave-lengths. (Because electricity travels at a uniform speed of 186,000 miles a second, a short wave-length means that a large number of waves occur each second, hence they have a high frequency. Frequency is expressed in cycles. One thousand cycles are called a kilocycle, one million cycles a megacycle.) Each FM station is allowed a channel 200,000 cycles wide, compared to the 10,000 cycle channels of standard broadcasting.

Range—High frequency radio signals have some of the characteristics of light, and like light are unable to follow the curvature of the earth. As a result, FM signals generally cannot be heard more than 100 miles from the broadcasting station. Television stations are similarly limited in range because they also broadcast in the higher frequencies.

A New Horizon for Cinematography

Several papers presented at the recent 59th Technical Conference of the Society of Motion Picture Engineers were of such scope and pertinency as to be of particular interest to projectionists. Summaries of these papers having now been made available, extensive excerpts therefrom are presented in the adjoining columns.

WHEN you go to see the filmplay of tomorrow, you may be "in the play" instead of an observer on the sidelines. You may see everything and hear everything in normal surroundings, as in real life, for the action may be taking place "around" you as the picture is projected on a dome-shaped, planetarium-type screen, with stereophonic sound coming to your ears from varying angles and directions.

What is more, both sound and pictures may possess a new order of realism, made possible by the use of a high-speed lightweight, noiseless television camera, employing the super-sensitive image Orthicon pick-up tube, to record the picture. These and other dazzling possibilities for future production and exhibition of motion pictures were visualized by Loren L. Ryder, recording chief of Paramount Pictures, in his SMPE presentation.

Mr. Ryder sketched the prospect of a bright, expanding horizon for the motion picture industry in an appeal for closer coordination of development work between departments within the industry and between the industry as a whole and the equipment and supply manufacturers, in order to speed the application of wartime scientific and technological advances to the making the 35-mm motion pictures.

Pointing out that motion picture sound, like radio, was an outgrowth of World War I, he said that the vast developments of World War II, of which we are now beginning to feel the impact, include many techniques and devices which are applicable to motion picture work. As an example, he cited the war experience of the armed forces with stereoscopic gun trainers which were operated in a hemisphere to make the images of planes and ships more realistic to trainees than they would be on a flat screen.

A Planetarium Theatre?

"Perhaps the theatre of tomorrow should be a planetarium," he said, "in which the audience would see and hear everything in normal surroundings. Possibly a sector of a sphere of grandeur size will accomplish the desired effect."

Stating that war developments in optics "have exceeded our fondest expectations," he suggested that it may become possible to produce pictures that will be equally satisfactory to patrons in the front, middle, and rear seats of a theatre. Twentieth Century-Fox has made a test demonstration of 50-mm color film on a large screen backed by stereophonic sound, he said, adding that there are varying opinions as to whether sound, to match stereoscopic pictures, will have to be truly three-dimensional, rather than coming from two or more horns behind the screen.

Referring to the new RCA Image Orthicon, Mr. Ryder said that this tube, which has a light-sensitivity approaching that of the human eye, may point the way to a higher speed, lighter, noiseless camera, which would be used with a picture recorder operating off-stage in a manner similar to that used in sound recording. "The light amplifier demonstrated by Dr. Zworykin," he said, "may even have application to existing types of cameras and lenses."

General Lighting Requisites

In the field of lighting for film production, he said, it may be found that the presently used 120-volt potential is not the most effective and efficient voltage for gaining illumination. He suggested also that the industry might profitably study the advantages of lighting power supplies of higher frequency, pointing out that a 400-cycle supply has become standard for aircraft and much of the Army and Navy equipment, both on shore and at sea. At this frequency, he said, transformation is simple and the desired voltage can always be available at the point of usage. At this higher frequency, he added, some of the light sources now being developed, such as the discharge lamp, high-intensity fluorescents, and incandescents may operate more effectively and without flicker.

"There is also a need for some type of general lighting for large fixed sets and backing," he said. "Back-lot shooting areas should be enclosed to eliminate shadow trouble and sound interference from airplanes. This cannot be done today, because there isn't enough lighting equipment in Hollywood, excluding the sun, to light any large street for Technicolor shooting."

One wartime development which is already finding adaptation in the film industry, Mr. Ryder said, is gyro-stabilization with servo-control, which was used in the war for gun pointing. Some of the studios are developing similar equipment to gain greater utility with the camera, he said, and it may eliminate the costly practice of building tracks and special roadways for dolly, camera boom, and camera car shots, as well as facilitate repetition of mechanical movement during picture shooting and special effects work.

The present 35-mm cameras are "too large, too heavy, too noisy, and too covered with gadgets," he declared, and it is to be hoped that studio arc lamps can be made lighter in weight, more convenient, and more effective. He also listed desirable improvements in sound recording equipment and set construction, asserting that the latter has not been modernized in years.

The theatrical business needs a completely new expendable material for set construction, he said. It should be a material that can be put together in a manner similar to cartoon construction and abandoned after picture shooting. Fast-drying paints are also needed, he said, especially paints with a high gloss which can be sprayed on floors between takes to retain the mirror-like effect desired for dance numbers. New plastics, plywood, adhesives, and glass products, Mr. Ryder said, should all find their way into motion picture making.

"It is my hope," he said, "that it will be possible in the immediate future for the motion picture industry to give the manufacturers a more complete statement of its requirements, which should make manufacturing more certain, more profitable, and more modern."

THE solution of current problems related to television, photography, and human vision may be aided by a unified approach and consideration of the limitations and possibilities of these devices in common terms, it was suggested by Dr. Albert Rose, of the RCA Laboratories, Inc.

Dr. Rose pointed out that the three picture pick-up devices — photographic film, the television pick-up tube, and the human eye—are all subject ultimately to the same limitations in performance, imposed by the discrete nature of light flux. Dr. Rose is one of three RCA scientists mainly responsible for the development of the RCA Image Orthicon, recently-introduced supersensitive television pick-up tube.

In the large technical literature that has been built up for each of the three picture pick-up devices, he explained, the language, units, concepts, and conclusions are not now in a form which allows them to be readily compared. In films, for example, we speak of graininess; in pick-up tubes, signal-to-noise ratio; and in human vision, minimum discernable con-

(*Continued on page 29*)

TELECASTS

IF TELEVISION has had one major handicap, it is the fact that the video art has been subjected more to sensational ballyhoo than to dispassionate appraisal, observes Jack Gould, radio editor of *The New York Times*, in a blunt analysis of current television prospects. Continues Gould:

Over the years, professional prophets have spread the gospel of its imminence, envisaging in nothing less than superlatives the coming hour when the whole world will be brought into the parlor. Unrestrained speculation and prediction as to television's implications have been the accepted order, resulting generally in the unqualified conclusion that television is here and ready now to revolutionize the nation's cultural and entertainment habits.

In the best interests of television itself, the time would seem propitious to call a halt to this orgy of nonsense. The extravagant claims being made or suggested in many quarters are largely incapable of immediate fulfillment, as most industry leaders concede privately, and their persistent repetition is not hastening but retarding the realization of video's tremendous potential.

Hurting the Art

The sustained "over-selling" of television has reached the point where it is obscuring many of the art's very real accomplishments and making only more difficult the ultimate popular acceptance of the medium.

Where television seems to be doing itself the greatest disservice is in the implied promise of its best friends that it can emerge ipso facto as a major contender of the Hollywood entertainment films, the newsreels, the radio and the Broadway theatre. By ill-considered promotional efforts, television has set proposed standards so high in the public mind that it is not giving itself an even chance.

From the standpoint of the broadcaster and "viewer" alike, it is not fair to television to maintain that it has "arrived." It is a long way from that, it is to be hoped, if existing programming and reception standards are a valid yardstick. For, as it has been demonstrated up to now, be it in color or in black-and-white, television is only a suggestion of what it must be to justify the appellation of a "national service."

Economics of Industry

Programwise, it has hardly started. As a means of reporting sports contests and special events it indeed has proved immensely effective and a valuable new aid in entertainment and enlightenment. But in terms of original programming, night after night, there is no ground or reason for comparing it with other media. Television is simply not ready.

It is this enormous problem of continual programming that virtually dwarfs other phases of television. The motion-picture industry controls much of the country's top talent and has shown no inclination to share it with television as it has with radio. Adequate studio space, or the simple real estate requirements of video, will be a major factor in overhead.

The expense, in short, may rival that of the film industry, yet television can dissipate the value of its product in a single evening, while Hollywood allows years for a financial return on its wares. Added to this is the fact that the advertiser will have to be convinced that it is smart business to spend a great deal more for television than he does for radio, yet at the same time be satisfied for a number of years with a much smaller audience.

To recite these economic problems is not to argue that they are insurmountable. But it is to stress that they are very real and difficult of quick solution, particularly since many are linked to the national economic welfare, and that their existence in large measure will decide when video can "arrive."

Receivers Held Inadequate

On the receiving end the need for a reasonable perspective is no less. The best receiver thus far shown publicly, providing an image that could bear comparison with home "movies," has a screen only 6 x 4 inches, and that is not of sufficient size for relaxed and sustained "viewing" by a family group. The larger screens produce images as yet unsatisfactory in terms of brilliance or definition.

Though some engineers claim to have the problem solved, television aerials for congested metropolitan areas, notably in apartment houses, have not yet been demonstrated. Here, again, it is not a question of minimizing television's acknowledged progress in improvement of receivers, but it is a question of guarding against unwarranted exaggeration of it. A very great deal remains to be done.

There are other factors which similarly dictate a cautious approach to television. These include withdrawal in recent weeks of more than sixty applications for television stations, chiefly because of the expense involved in the years before a video station can hope to become self-sustaining and because of uncertainty created by the CBS vigorous campaign for high-frequency color video.

An Artificial Boom

Too, there have been concurrent delays in the construction of both transmitters and receivers as well as a slackening off in broadcast advertising, a development which has tended to turn attention away from new radio techniques.

But this "gloom" seems all the more marked because of the artificial "boom" in television crystal-gazing which preceded it. Regardless of what technical system is employed, television at best faces an uphill fight against unique and unprecedented odds, as it always has. The day unquestionably will come when television's performance will more than match its present promise, and then video can really blow its own horn. But that time is not now.

RCA SERVICE RENEWS 116 HOUSES

Renewal of RCA service contracts with Paramount-Richards Theatres, Inc.; United Theatres, Inc., and the Dixie Theatres Corp. has been effected. These contracts cover 102 theatres located in the southwest U. S. Also renewed were contracts with the Northio Theatre Corp., of Cincinnati, covering 14 theatres.

Motion Pictures in Public Carriers

By *TECHNICAL STAFF, BELL & HOWELL COMPANY*

THE TREND toward wider use of motion pictures for recreation demands that we visualize their use in commercial passenger transportation. Already tested with highly gratifying results, the use of motion pictures for passenger entertainment is on the threshold of tremendous growth. The latest manifestation of this trend in modern entertainment was the premiere showing of a feature film on a Pan-American trans-Atlantic plane.

It follows naturally that the quality of the recreational presentation must be in line with the high standards set by the railroad, airline, or bus company in other phases of passenger comfort and convenience.

In considering a program of installation to bring movies into the public conveyance, a basic factor is the seating arrangement. Every member of the audience must be able to see and hear the program clearly. Seating space on common carriers is more or less static. This fact renders the relationship and location of projector, screen and loudspeaker especially important.

Front projection is the type most commonly used, being customary in theatres, lecture halls, homes and schools. A suggested front-projection installation is shown in Fig. 1. The projector is located in front of the screen and behind the audience.

Screen Type, Positioning

The screen may be of the glass-beaded type. The width of the screen, for ideal conditions, should be approximately one-sixth of the distance between projector and screen. The row of seats nearest the screen should be about two and one-half times screen width distant from the screen.

It is recommended that the screen be located so that it is as high as possible above the floor of the conveyance, in order to prevent obstruction of the light beam by the audience. Installation of a sliding panel in the end wall, with the screen permanently placed, is suggested. When installed in this manner the screen can be recessed several inches so as to produce a "shadow-box" or screen-darkening effect for better image visibility under semi-darkened conditions.

Mounting the Projector

For front projection it is recommended that the projector itself be suspended from a small platform above the heads of the passengers near the center of the car or above the heads of the attendants inside a service enclosure as indicated in Fig. 2. Distance from projector to screen thus will be anywhere from 10 to 25 feet. In an average installation of this type the size of the screen image produced will be 44 inches wide by 33 inches high, or thereabouts.

Various lens-to-screen distances and lens focal lengths can be utilized to produce screen images of various sizes at given distances. Such measurements can be computed readily, to suit exact space requirements, by consulting Table 1.

It will be necessary to suspend the projector rigidly from the ceiling on a platform whose top surface lies at least 40 inches from the ceiling. The platform should be capable of supporting at least 55 pounds of weight. A suggested support arrangement is indicated in Fig. 2; the platform is a sheet of 10-gage steel, 30 x 12 inches in size, which is supported by four lengths of ½-inch steel tubing.

For purposes of planning and design, it should be borne in mind that the approximate weight of the Filmosound projector (without speaker) is 53 pounds, outside dimensions being 36 x 28 x 9 inches.

Where the projector is placed in the passenger area of the conveyance rather than in a service compartment, storage facilities and appearance can be enhanced by designing the platform in such a way that it will form a part of the ceiling when not in use. Provision could be made to raise and lower the platform silently and quickly at the beginning and end of showings.

FIGURE 2

While in some cases one speaker may suffice, it is recommended that two speakers be used for best results. These can be installed in or on the ceiling; or it might be desirable to place one speaker below the screen and the other in the ceiling.

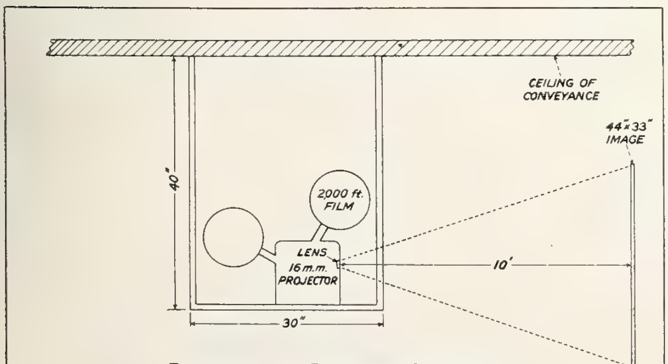
Rear Projection Setup

As distinguished from front projection, rear projection has much to commend its use in passenger conveyances where semi-darkened conditions prevail. In this discussion, rear projection is taken to mean a system whereby the projector is placed behind a translucent screen and the image is viewed through the screen from in front of it. Obviously, a major advantage here is that the audience is never located between projector and screen where interruptions of the light beam may occur.

To house a rear-projection unit, including projector, mirrors, and screen, a compact booth can be constructed just inside the steward's compartment. Fig. 3 illustrates simply how rear projection works. The beam of light from the projector is aimed onto a mirror, A, thence

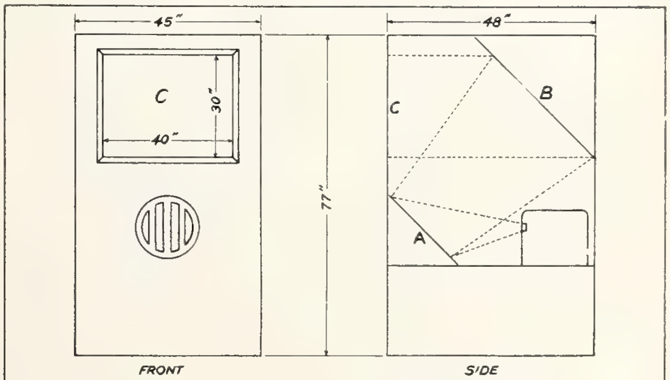
(*Continued on next page*)

FIGURE 1



PROJECTOR ON PLATFORM SUSPENDED FROM CEILING FOR FRONTAL PROJECTION

FIGURE 3



REAR PROJECTION CABINET

to a larger mirror, B, and from B through a translucent screen, C.

The mirrors employed in this system are front-surfaced, affording high reflectivity and very little loss of light. They should be installed permanently and rigidly. Mirror A is 5 inches wide by 4 inches high, while Mirror B is 22 inches wide by 18 inches high. The screen is 40 wide by 30 inches high.

For a permanent installation in a small interior the speaker can be built right into the rear-projection unit. It is recommended, however, that in most instances the dual-speaker arrangement described previously be utilized. In any case, there should be provision for controlling sound volume from outside the rear-projection booth as well as inside it.

Rear Projection Advantages

Without attempting to evaluate the desirability of either front or rear projecion in any given instance, it is felt entirely proper to point out the following advantages of rear projection in the field of transportation:

1. Save space, which is always at a premium on public conveyances.

2. The projector is protected considerably from dust and dirt.

3. There is no mechanism, platform or beam of light to interfere, or be interfered with, in the passenger area of the conveyance.

4. Located within its booth or enclosure, at normal height, the projector is easier to thread, operate, service and repair.

The standard Filmosound projector is designed to operate on 115-volt A.C. Electrically, the projector consists of three components: the motor, which drives the film moving mechanism; the projection lamp, and the amplifier. The motor and the lamp can be connected to 115-volt A.C. or D.C. power sources, but the amplifier must be fed from an A.C. source only.

Since the larger power consuming elements, the lamp and motor, can be connected to A.C., the Filmosound incorporates one input receptacle for these two components and another input receptacle for the amplifier. Thus, if only D.C. is available, the projector motor and lamp can be connected directly to the D.C. source and the amplifier to a small converter.

If the equipment is to be operated on voltages lower than 115, special low-voltage lamps are available. The light output of these special lamps will be less than that of the 1,000-watt lamp. Provisions can be made for operating the motor and amplifier on the lower voltage.

Lens Focal Length	Distance in Feet from Screen to Film				
16 mm. Projector	8'	10'	12'	15'	20'
	Width and Height of Picture				
3/4"	0'11" 2'11"	4'11" 3'8"	7'6" 4'5"	9'11" 5'7"	12'6" 7'5"
1"	2'11" 2'2"	3'8" 2'9"	4'5" 3'4"	5'7" 4'2"	7'5" 5'7"
1 1/2"	1'11" 1'5"	2'5" 1'10"	2'11" 2'2"	3'8" 2'9"	4'11" 3'8"
2"	---- ----	1'10" 1'4"	2'2" 1'8"	2'9" 2'1"	3'8" 2'9"
2 1/2"	---- ----	1'5" 1'1"	1'9" 1'3"	2'2" 1'8"	2'11" 2'2"

TABLE 1

Projected picture sizes obtained with Filmo projection lenses.

Notes on Studio Projection Process

By *MERLE H. CHAMBERLIN*

CHIEF PROJECTIONIST, METRO-GOLDWYN-MAYER STUDIO

THE M-G-M projection department has been favored during the past ten years with a lot of swell visits by projectionist readers of this magazine. One phase of studio projection operations that seems to elicit various stages of amazement is the number of times our crew of 53 projectionists put the same scene through the projection facilities on the lot. These facilities consist of 24 rooms (or little theatres), 7 Moviolas, 4 process booths, plus scoring stages, synchronizing stages, etc.

After a scene is processed in the laboratory, it is assembled with the rest of the "rushes" and projected for inspection of light density and print quality. The sound track, a separate reel, is then put with the picture and both are then checked, by projection, by the Sound Department. The cutter then takes over and "projection-checks" for usable scenes.

Those runs are just the start of the projection life of that reel of "rushes."

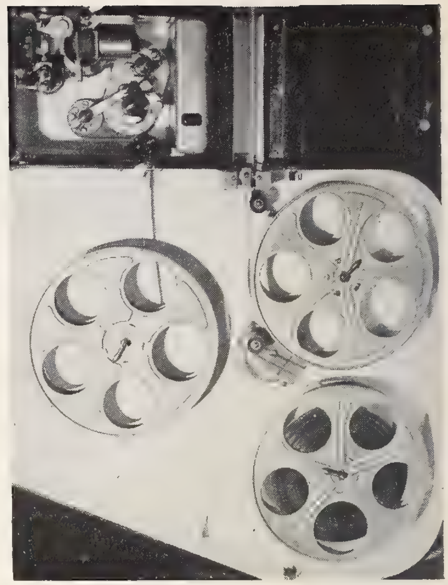


FIGURE 1

The producer, director, cameraman, and any number of lesser lights must all look at that reel. One fact that must be realized is that for every scene in a picture there is a myriad of "unseen" departments involved. Makeup, wardrobe, casting and all the rest, while not physically present when the scene is being shot, naturally have a definite stake in the outcome. So they must all see the results, and those results must be truly represented. Mechanical, optical and electronic reproduction must be as near perfect as possible.

After the "rushes" are approved, the cutter breaks down his reel and cuts the scenes into the work print of his picture. Needless to say, the number of times that film is again projected for corrections, additions and deletions is very high. When all scenes are the required length and the picture has received its final approval, there is more projection. Effects and music must be added, re-recording to one sound track must be accomplished, and then the picture is prepared for preview.

Dual Film Projection

Previews are held in theatres in neighboring communities in an attempt to secure public reaction before the negative is cut and the composite, or movietone, print is made. Up until the time the composite print is made projection is done by "dual film." All equipment includes dummy attachments for the projection of separate picture and sound reels (Fig. 1).

An estimate of a projectionist's work in a studio is on the same basis as in a theatre. Any material or creative contribution to the making of a motion picture can be judged only as a result of the projection of that picture. The studio projection audience is super-critical due to the fact that their efforts are what the projectionist is reproducing. For that

reason, studio projection standards are set high and maintained that way.

Cooperation from the management in the matter of equipment is not only necessary but has ben evidenced by the placing of orders within the past 30 days for complete modernization oi the department. If there were some way to get a lot of theatres to do the same thing, we'd all be able to reproduce this product in a manner commensurate with the effort that is put forth to get the picture before the public through the medium of those theatres.

Prior to the war M-G-M policy made it possible for I. A. projectionists visiting Southern California to make a technical tour of the studio. Now that hostilities have ceased, that invitation is again extended. If you are out on the Coast on your vacation, contact either the writer or Local 165 and arrangements will be made to show you through the plant.

'Yankee Ingenuity' Solved Army Projection Problems

There were not enough projectors to go around during the early days of the war, and many and all models, irrespective of vintage or type, were pressed into use, relates Major A. Kissack, Jr., of the U. S. A. Signal Corps. Continued the Major:

"The problem was particularly critical overseas where conditions were so rugged that projectors took an awful beating. Damp humid climates, extremes of heat and cold, rain, sand and dust, continuous operation, and terrible transportation difficulties were too much for equipment designed for home use. Replacement parts were not only scarce, they were often unavailable.

'Cannibalized' Equipment Setups

"Yankee ingenuity was the only thing that made it possible for the show to go on. Equipment was cannibalized, new projectors and amplifiers assembled from parts of many others. Public address equipment was hooked into projector sound systems. Tail-light bulbs from jeeps became almost standard exciter-lamp replacements. To furnish a brilliant picture and adequate sound for large audiences a 35-mm arc projector was completely dismembered, remodeled, and combined with a 16-mm machine.

"Meanwhile, motion picture engineers came to the rescue. Projection models and parts were standardized. Design was made sturdier for operation and for transportation under extreme conditions. Equipment was fungus-proofed. Standardized replacement parts began rolling off the line.

"Today the Army projector situation is in pretty fair shape. Yet much still needs to be done to increase the quantity, the quality, and the suitability of 16-mm projection equipment for changing needs."

3 NEW DeVRY DEALERS

The list of DeVry theatre supply distributors has been increased by the Quality Theatre Supply Co. of Omaha, Nebraska, operated by Carl White; Stanley Theatre Supply Co., on film row in Chicago, directed by Reuben and Stanley Levine; and Dayton Film, Inc., Dayton, Ohio, under the guidance of R. F. Poorman and Stewart Sheldon.

Next Month . . .
Special I. A. Convention Edition. Watch for it.

TELE IN MOVIE THEATRE?

(*Continued from page* 14)

two demonstrated so far. The first projector was demonstrated at the old New Yorker Theatre in New York City several years ago. The second was demonstrated to the writer on April 5, 1946, in Schenectady, N. Y.

The demonstration at the New Yorker Theatre several years ago did not impress me favorably and this was due to the poor illumination and only fair definition. The main portion of the program was a prizefight being held at Madison Square Garden. This telecast was not through the ether, but was brought to the projector by tuned telephone wire circuits, not coaxial cable. The television projector was located in the loge section of the balcony, at a distance of approximately 70 ft. from the screen, and projected an image of about 15 x 20 ft. I am given to understand that this projector is limited to a projection distance of from 70 to 80 ft.

In the Fall of 1945 I had an opportunity to again examine this projector. Although the projector was not demonstrated at that time, it was my conclusion that no obvious improvements had been made upon it since it was demonstrated at the New Yorker Theatre.

Due to the design and bulk of this projector, it could not be installed in any theatre projection room, even if it were possible to project the image at greater distance than that for which this particular model was designed. This will be discussed subsequently herein.

The demonstration of the second television projector was given in the very small auditorium of the Schenectady Civic Playhouse. The program consisted of motion picture film and live talent, which was picked up by the television cameras and fed through coaxial cable through a special low-power micro-wave frequency modulation transmitter located on a tower near the studio. The transmitter output was then beamed by a directional transmitter antenna toward the theatre, where it was picked up by another directional antenna and energized by way of coaxial cable through a special frequency modulation picture receiver, which then fed the picture to the projector. Sound was transmitted from the studio by means of radio link.

The size of the projected image was 11 x 15 ft., at a projection distance of 30 ft. The light and definition from this projector is superior to that of any others I have witnessed, although there still is room for considerable improvement before it can be used for practical, profitable entertainment in motion picture theatres. I have been informed that 30 ft. is the maximum projection dis-

tance for this projector. Projection distances in present-day theatres are from 60 to 210 ft., but no average is available.

The two television projectors outlined herein are known as the "Instantaneous System," whereby when a program is received from its source it is instantly projected on the screen. There is another type known as the "Storage System." This system takes the television program from its source, either off the air or through wire, and records same upon a super-sensitive 35-mm film which is processed in from two to five minutes and then projected through standard 35-mm motion picture projectors.

This latter system seems practical, but I do not know how it would look on the screen, as I have never had the pleasure of witnessing a demonstration. Granted, however, that it seems practical from an equipment point of view, why is it necessary and what obvious advantage has it?

Glorified Newsreel Angle

As for me, it seems to be just another way of presenting a newsreel. We certainly could not present this system to audiences as true television; and I would like to ask what is wrong with our present-day newsreel. I think they have done, and are still doing, a splendid job in bringing to the public visually and orally news subjects of great current interest. They certainly did a bang-up job in World War II.

Now let us consider the practicability of the two television projectors which I have seen demonstrated. Both have very limited projection distances; and just where could they be installed in present-day theatres? Engineers and manufacturers have made many statements regarding the installation of television projectors in theatres. Therefore I will first give the claims as made, and then give the negative side.

Claim: Due to limited projection distance, the television projector could be installed on the rear of the stage and the image projected through a translucent screen.

Negative: Most theatres throughout the U. S. have only sufficient room for the present horn system. If there were sufficient room back of the screen, what happens to the motion picture screen and horn system? Most theatres are not equipped to such an extent that it would permit the flying of the screen, let alone the horns. In those theatres which may be equipped to fly the screen and move the regular horns off stage to permit rear-projection television, is there a definite idea as to the added cost of labor required? The great majority of theatres cannot stand the additional expense.

Claim: Install a television projector in the orchestra pit.

Negative: Most theatres do not have orchestra pits.

Claim: Install a television projector in the basement just in front of present picture screen, using either a regular mirror or periscope system to project the image on the regular screen.

Negative: Most theatres do not have a basement in the screen area. Basements are usually under the lobbies and rear auditorium for heating and ventilating units and for use of stores which may

be a part of the entertainment project.

There may be other theatre television projectors on paper, but whether on paper or not, if television—and I do mean IF—is to become a part of the motion picture theatre, the design and manufacture of television theatre projectors must meet with the requirements of practical, profitable theatre operation.

Theatre television projectors should be designed and manufactured in such a manner that same, including the receiver and all its controls, could be installed in the present theatre projection room alongside of the motion picture projectors. The present film amplifiers and loudspeaker equipment should be utilized for the oral part of such television programs.

Such design and installation is a MUST, otherwise any attempt to install the equipment in places other than herein mentioned will cause jurisdictional labor disputes which will put the exhibitor right in the mildle and further make the cost of operation so great that it would be much more economical to install live stage shows.

In closing, I repeat what I said at the beginning of this article: I fail to see the box-office value of television in conjunction with motion picture theatre operation unless it may be the televising of coming feature trailers to homes. Of course, nothing is impossible, but things that are possible can be highly impractical. The two opinions I have expressed in this paper are that "The Show Must Go On," and the "Show Must Pay."

All that I have seen or heard about television for motion picture entertainment makes me believe that it is by no means ready for general use in movie theatres, and that it is unfair to halt progress in many other directions while waiting for that extremely indefinite period when the overwhelming number, not just a few theatres, can afford to install television.

Industry Earnings, Dividends

Consolidated net profit of Technicolor, Inc., and Technicolor Motion Picture Corp. for 1945, before various deductions including taxes, amounted to $1,592,692, compared with $2,488,731 in 1944. The 1945 net after all deductions was $667,441. Dividends per share of capital stock amounted to 50 cents, an aggregate of $452,894. Net earnings per share were 74 cents.

Strike conditions resulted in increased costs and diminished profit, nevertheless net sales reached a new high of $11,614,779. Despite the prolonged Coast strike, output of Technicolor's release prints jumped 1,507,247 feet to a 1945 total of 160,471,837 feet. Normal production would approximate 190,000,000 feet.

With net sales reaching an all-time peak of 22 million dollars in 1945, despite heavy cutbacks in Government orders, Bell & Howell Co. enjoyed the most productive year in its history. Net earnings for 1945 aggregated $672,491 after provision for taxes amounting to more than two million dollars. Preferred stock dividends of $77,250 were paid, with net profit on the common stock being $1.29 per share.

• • •

Bausch & Lomb Optical Co. reported a net income of $1,192,743 for 1945 equal after taxes, charges and preferred dividends to $1.69 a share on the 573,228 shares of common stock outstanding. Current assets at the end of the year including cash of $2,855,345 were 27 million dollars and current liabilities 10 million.

A NEW HORIZON FOR CINEMATOGRAPHY

(*Continued from page* 21)

trast. There is good reason now to say, he declared, that these terms are only three different names for the same characteristic.

Again, he said, we discuss the limiting resolution of film, the frequency response curve of a television pick-up tube, and the minimum resolvable angle of the eye, although it is obvious that in each case an attempt has been made to count the number of separate picture elements involved.

Citing sensitivity as a third illustration, he said that variety and confusion have characterized the sensitivity scales proposed for film, and that only recently have there been fundamental attempts to measure the sensitivity of the eye in terms of its quantum efficiency. The sensitivity of a television pick-up tube can be defined with reasonable adequacy, he said, by its micro-ampere signal output per lumen input.

Fluctuations representing the "signal-to-noise ratio of the eye" are observable, particularly at low light levels, Dr. Rose said, just as graininess in film and noise effects in a television image are observable. At these low light-levels, he said, a white surface takes on a grainy appearance, not unlike that of motion picture film. In complete darkness little or no fluctuation is detectable, he pointed out, indicating the virtual absence of local noise sources in the eye.

Near threshold brightnesses, he said, large-area, low-amplitude fluctuations appear; while at higher brightnesses these fluctuations increase in amplitude and decrease in size.

A secondary observation, according to Dr. Rose, is that low-level blue light appears distinctly more grainy than low-level red light, which conforms to the assumption of a gain control mechanism in the eye, altering the visibility of noise by presenting the picture at a higher or lower brightness level. This mechanism, he pointed out, can be assumed to be set higher for blue than for red.

Comparing the relative quantum efficiencies of two devices transmitting the same picture, he exhibited a table indicating that the eye is 250 times as effective in viewing as the camera is in taking motion pictures. Not all of this factor can be ascribed to the lower quantum efficiency of film, he said; part of it is a result of the high gamma of the printed film, which requires a higher than normal signal-to-noise ratio in the negative, and part of it can be assigned to the fact that film should exceed, rather than just match, the signal-to-noise ratio of the eye.

DR. PETER GOLDMARK, who is Director of Engineering Research

and Development for CBS, declared that electronic color television "would have to be very good, indeed," to match the results obtained with CBS's present mechanical system. It can be shown analytically, he said, that the color television system now used by CBS has been arrived at by a careful consideration of all possible color processes. It was found early in the CBS investigations that, because of certain characteristics of television techniques, the choice of color systems is a narrow one; hence, the present system seems to be the only one that is feasible and practical in the light of present knowledge.

"The color fidelity of this system is very high and is capable of surpassing that of photographic processes. The system used and proposed by CBS was arrived at without regard to whether the receiver should embody electronic or mechanical means of color selection.

"If and when electronic color selection is developed, mechanical color receivers will not become obsolete, because the system is fundamentally tailored for use with either type of receiver. At best, electronic means of color selection can only produce color images of a quality equal to that obtained by mechanical means."

Improved Film-Tele Technique

Other speakers on television revealed an improved technique for using negative motion picture films as source material for television programs, the development of a new film for use in photographing the images on television picture tubes, and the initial results of comparative studies of the television pick-up tube, photographic film, and the human eye as picture pick-up devices.

A report by the Television Projection Practice Committee of the SMPE called for early agreement by the various branches of the motion picture industry on both commercial and technical aspects of theatre television, so that the committee may crystalize information already assembled on theatre television equipment, theatre facilities for television installations and standards of image quality, and proceed to make specific recommendations.

NEW postwar test equipment for theatre servicing was discussed by Edward Stanko and Paul V. Smith, of the RCA Service Co. Pointing out that the continual improvement of motion picture sound equipment imposes increasingly rigorous requirements on field test equipment, the paper stated that wartime developments, including new miniature tubes and components, have been incorporated in a 1946 model test kit, which is now in production.

"During the war," the paper continued, "instrument research has been greatly accelerated. The advent of alnico magnets has made possible stronger magnetic fields, more rugged moving systems, and higher-torque springs, all of which contribute to accuracy, ruggedness, and reliability, as well as lighter weight. Miniature tubes have been developed which can stand the shock of being fired from a gun in an anti-aircraft shell. Tubes incorporating these developments will withstand

the shocks incident to use in portable equipment much better than prewar tubes."

New RCA Model Test Kit

The new kit consists of a varnished, reinforced fiber case, with compartments for the various instruments. When the lid is closed, these instruments are held firmly in place. Including all instruments, it weighs 35 lbs. The case contains an RCA VoltOhmyst; a standard socket selector kit; an A.C. voltmeter and decibel meter; an A.C.-D.C. ammeter; a 150-ampere, 50 millivolt-drop shunt; a Triatic Signal Tracer, and other units, all of new and improved design.

DON'T argue with your wife if she accuses you of having made a horrible color match in that dress fabric you bought for her. You're both right, and argument is futile, particularly if you are the blue-eyed husband of a brown-eyed wife, according to Dr. I. H. Godlove, color scientist of the General Aniline and Film Corp.

Dr. Godlove explained that you can't hope to "see eye-to-eye" with your wife, business associates, or anyone else, unless you and they have the same visual response to different color mixtures in the light by which you observe a colored object.

'Normal' Color Vision

In the filming and processing of motion pictures, it was pointed out, this varying color response of the human eye requires constant study and attention, since color in a motion picture may be viewed by thousands of persons. To satisfy the color appreciation of movie-goers as well as buyers of fabrics and other consumer goods, producers of these commodities look increasingly to science for the means of achieving the best color characteristics for the average eye.

"One person of normal vision may require 30 per cent of red light and 70 per cent of green light to match a given yellow," Dr. Godlove said, "while this proportion may have to be reversed to enable another person of normal vision to make the same match. Moreover, blue-eyed and brown-eyed persons match colors differently. The blue-eyed match colors at one end of the color spectrum, and the brown-eyed at the other end. The match made by the blue-eyed looks terrible to the brown-eyed, and vice versa."

Color is a hybrid, Dr. Godlove said, and the job of the colorist is to correlate the two extremes of color stimulus and color perception by means of the intermediate—the hybrid color. He hailed the advance in color science which has enabled trained specialists in this field to devise color scales which solve a wide variety of consumer color problems. These color scales conform to what the average layman sees, thus crystalizing and making more definite the consumer's way of seeing and thinking about color.

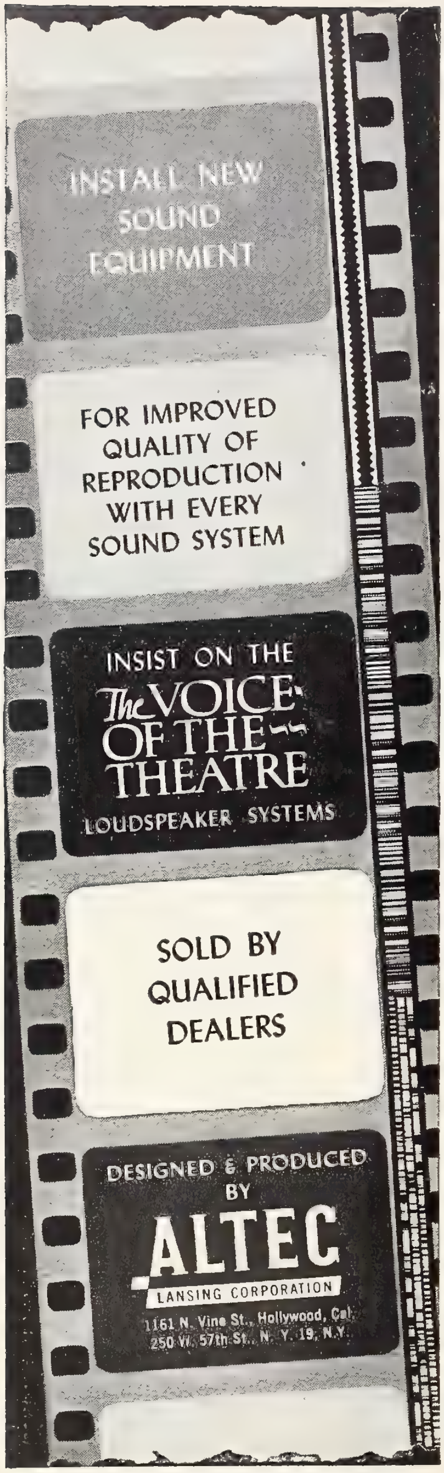
Spectral Energy Distribution

At the same session, Ralph M. Evans, of the Eastman Kodak Co., said that not only the color, but also the spectral energy distribution of the light source, effects the colors obtained in motion pictures. For example, he said, a red object may photograph red with a given light source, while with another light source, which matches the first one visually but has a different distribution of energy at the different wave lengths, the object may photograph green.

Though the human eye adapts to the color of the light source, he said, this adaptability does not overcome the effect of differences in energy distribution.

COMMENTING on the high cost of poor projection, P. A. McGuire, of International Projector Corp., suggested a complete survey of all projection facilities in the motion picture theatre field. Noting that such a task might entail the expenditure of from fifty to one hundred thousand dollars, "Mac" stated that the survey would pay for itself many times over in improved projection and the pre-

(Continued on next page)



NEW FILM HORIZONS

(*Continued from preceding page*)

vention of much film present mutilation.

Unfortunately, what is everybody's business is usually nobody's business, continued "Mac," who cited the fact that today everybody accepts the fact that projection is a vital, often a determining, influence upon box-office receipts. Better projection, he said, is embodied in all the plans and purposes of the SMPE, no less than in those of the entire industry's technical forces, because of the universal recognition that projection constitutes the final delivery of all the work of the industry.

"Mac" said that before the war the average age of projectors was more than 13 years; today the average age is closer to 20 than to 15 years.

The curse of the film exhibition business is obsolescence, said Mac, because it affects every branch of the industry: detracts from the dramatic content of the picture and thus renders ineffective the efforts of the writer, the director, and the star; occasions a severe economic loss in terms of hundreds of thousands of feet of mutilated film annually, constitutes a positive drag on box-office receipts, and, of the utmost importance, endangers the safety of the audience and the projectionist.

Projection is the payoff, said "Mac," for the simple reason that the sum total of industry effort is contained on a narrow ribbon of film which must be properly projected before it can be translated into saleable merchandise.

B. & H. SNIPERSCOPE DEVICE

The recent unveiling of the "sniperscope," the Army's infrared telescope for seeing in the dark, reveals another top-secret example of the engineering skill and ingenuity manifested during the war by Bell & Howell Co.

Without going into too much detail, it can be said that the infrared telescope is the equivalent of a spotlight-and-viewer combination utilizing rays which are visible only to the user or to persons similarly equipped in the same vicinity. Infrared light rays long have been recognized and used in photography. An infrared-sensitive film, for example, will record the image of a hot (but not necessarily red-hot) flat-iron in a completely darkened room. Heat rays can even fog ordinary film in total darkness (as when a loaded camera is left in the glove compartment of a sun-drenched car). And the ability of infrared film—used in conjunction with the proper filters—to record images through haze when other means failed was common knowledge to the amateur photographer.

I. A. ELECTIONS

LOCAL 164, MILWAUKEE, WIS.

Glen Kalkhoff, *pres.;* Walter Behr, *vice-pres.;* Robert Lucht, *rec.-sec.;* Geo. Wittman, *treas.;* Otto Trampe, *business representative;* August Mommer, *sgt.-at-arms;* Geo. Brader, John Black, F. De Lorenzo, Joe Kriesel, *exec. board;* Otto Trampe and Glen Kalkhoff, *del. to I. A. Convention.*

LOCAL 324, ALBANY, N. Y.

Cavan Kelsey, *pres.;* John Ray, *vice-pres.;* Frank Matthews, *rec.-sec.;* Wm. Foley, *treas.;* Edward Fisher, *bus. agt.*

LOCAL 552, ST. PETERSBURG, FLA.

George W. Pettengill, *pres.;* Paul E. Barnes, *vice-pres.;* Frank N. Barhydt, *sec.-treas.;* A. H. Greeley, *bus. agt.;* H. E. (Jack) Crawford, *rec.-sec.*

Next Month—

Special I. A. Convention issue. A gold mine of technical and craft data.

PERSONNEL

Douglas F. G. Eliot, general purchasing agent in charge of purchasing for Western Electric Co., has been elected a vice-president of the company. As general purchasing agent for W. E. during the war years, Mr. Eliot was responsible for the procurement of all raw materials, supplies and equipment required in supplying more than 2 billion dollars worth of electronic and communications equipment for the Armed Forces. Also, Mr. Eliot supervises the purchase of material supplied by W. E. to the Bell System. He has been with W. E. for 36 years.

• • •

E. S. Seeley, Development and Research Engineer in the Commercial Engineering Group of Altec Service Corp., has just been appointed a member of the Electro-Acoustics Committee of the I. R. E. by the board of directors of this organization.

• • •

Paul F. Harper, equipment control supervisor of Western Electric's ERP division in Hollywood, and until recently Lt. Colonel in the Army, received the Legion of Merit for "outstanding initiative and ability in accomplishing distribution of ordnance supplies and ammunition and maintaining depot stocks to meet unprecedented demands."

• • •

Will Whitmore of the Western Electric Co. is en route to Bikini Island for the atomic bomb tests to be held this summer. Mr. Whitmore is a member of Army-Navy Task Force One, which is responsible for all electronics activities connected with the atomic bomb tests.

• • •

George L. Best, formerly assistant vice-president of A. T. & T., has been elected vice-president of Western Electric Co. Mr. Best, who joined the Bell System as an assistant engineer in 1922, will have charge of securing necessary licenses under patents of others for use by the Bell System, and for licensing others to use Bell inventions.

• • •

Major Robert S. Merchant has returned to the Altec Cincinnati District and will make his headquarters at Barbourville, Ky. Prior to active duty with the Signal Corps, U. S. Army, in 1941 he was at Altec headquarters in Columbus, Ohio. Assigned to radar and communications, he served in Scotland, England, and France and was Army-Navy Liaison officer in charge of all communications set up for Navy in Cherbourg, France. Later he was assigned as electronic engineer on development of atomic bomb material.

• • •

Recently released after three years Navy service in aviation ordnance, C. H. Percy has rejoined Bell & Howell Co. and has been named secretary of the company and a member of the board of directors.

• • •

T. Keith Glennan, manager of administrative services, Ansco Division of General Aniline and Film Corp., has been awarded the Navy medal for merit for "outstanding services" while serving as resident director of the New London Laboratory of Columbia University, Division of War Research. Mr. Glennan was formerly studio manager for Paramount Pictures, Hollywood, and previously was with the Academy of M. P. Arts and Sciences.

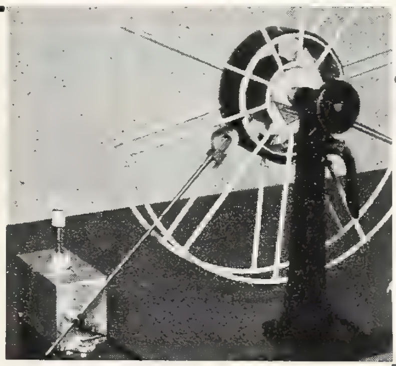
National Mags Offer Two Different Video Slants

Two recent articles in national magazines present contrasting aspects of the tele art. *Fortune*, the big magazine for big businessmen, in the article "Television—A Case of War Neurosis," diagnoses the television industry as suffering from "advancing schizophrenia, induced by protracted frustration and characterized by alternating guilt and persecution complexes . . . heightened by an alarming case of war neurosis."

Pic, the picture monthly, features "Television as a Career," in which is discussed possibilities for careers in engineering, production, retailing, etc. with veterans especially in mind.

W. E.'s New Buffalo, N. Y., Plant

Western Electric has leased the Kenmore Plant of the Curtiss-Wright Corp. in the town of Tonawanda and the city of Buffalo, N. Y. Comprising 760,000 square feet of floor space, the plant will manufacture switchboard cable and other telephone products and is expected to employ 3,000 people when in full production.



Presenting: Earl J. McCannel

THE manner in which the I. A. spread across the North American continent is perhaps best exemplified by the formation of locals in centers like Fargo, North Dakota. There, more than 30 years ago, a boy, 14 years of age, employed as a prop boy at a local theatre (rate: 50 cents per show) encountered I. A. roadshow men and dreamed of a Local for his home town.

Three years later the local was formed, as No. 510, and its moving spirit then and now is Earl J. McCannel, whose activities down through the intervening years is indicative of that which is best in trade unionism and good citizenship.

A truism of show business is that the small town is the backbone of the motion picture industry; and that holds true also for the relationship of any small local to its International. Not much publicity accrues to the small local, by reason of geographical location and limited membership, but the combined efforts of such groups in behalf of any International often outweigh in importance the contributions of big-city locals.

That's the way Earl McCannel sees it, and his record affords ample justification for that viewpoint. Secretary-treasurer of Local 510 for the past 22 years, Earl has also served on all wage-scale committees for the past 25 years; was president of the Central Labor Council for 2 years, and has attended 7 I. A. conventions.

Local 510 has insisted upon and obtained signed labor contracts since 1925. Twenty years ago Earl McCannel helped create the State Board of Electricians, a 5-man group of which not less than 2 and frequently 3 members have been I. A. men. Projectionists must have a *State license* to work in North Dakota. Earl is proud of his membership in the 25-30 Club of Greater New York.

Extensive Civic Activities

Contemplation of his civic activities leaves one breathless. They include: chairman of local Red Cross Chapter for 3 years, and still a member of the board of directors; member of County Welfare Board for 10 years; State Chairman of County Welfare Board Members Association, 1 year; for the past 5 years a member of Fargo City Planning Commission; member, Industrial Planning Committee of local Chamber of Commerce.

One needs no slide rule to calculate the influence and prestige accruing to Earl's local and to Labor in general, as a result of such diverse and extensive civic activity.

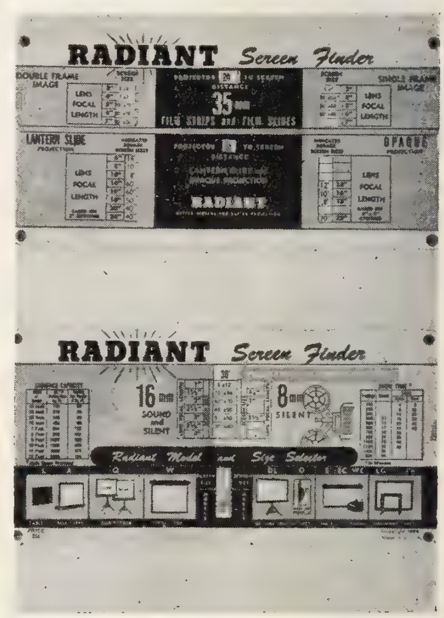
Two children, Mary and Harold, have graced the McCannel household. Mary is married to an Air Force officer, while Harold is a Captain of a radio intelligence unit still serving in France. In civil life Harold is an electrical-mechanical engineer with General Electric Co.

Focal point of Earl's interest these days is "a little white cottage on a beautiful lake in Minnesota, just 44 miles from Fargo," to which he and Mrs. McCannel yearn to repair for an extended session of fishing and just lolling around—a most welcome respite from the Winter season which in Fargo not infrequently features mercury readings of 20 below zero. After that? Well, Earl is fixin' to take a really long trip and retrace the many criss-cross trails that mark his travels through the years.

I. A. men throughout the country will be glad to welcome an old friend and one who represents all that is best in trade unionism.

PROJECTION SCREEN FINDER OFFERED BY RADIANT

A new, slide-rule type Projection Screen Finder for the users of opaque, movie, slide, and strip film projectors has been introduced by Radiant Screens. This colorful screen finder lists information on the correct screen model to use and on the audience-handling



capacity of a given screen, in addition to permitting the solution of such problems as the correct screen size to use, the correct distance from the screen to the projector, and the correct focal length lens to use. This useful data, available by a simple movement of that handy slide, is an invaluable aid to all projection screen users. With all this information at his fingertips in a simple form, the user need never wonder whether he has the right lens and the right distance to the screen in order to provide clearly visible pictures for his entire audience. Available from Radiant Mfg. Corp., 1140 West Superior Street, Chicago 22.

IN TWO SECTIONS * SECTION ONE

INTERNATIONAL PROJECTIONIST

JULY 1946

VOLUME 21 • NUMBER 7

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INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

HENRY B. SELLWOOD, *Editor*

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MONTHLY CHAT

IT IS highly significant that a specialized periodical developed to the craft and problems of the projectionist can flourish; and it is noteworthy that an enlarged and extensive issue of such a periodical, as presented by Section Two of this edition of INTERNATIONAL PROJECTIONIST, can be launched on occasions of special interest to projectionists.

Such happenings would have been unimaginable a scant twenty-five years ago; and it is a tribute to those who have consistently labored in the interests of projectionists during the past two-and-one-half decades that such events should have come to pass.

The elements of strength of any group of projectionists, as well as their fellow craftsmen in the allied arts, are their careful training, their expert skill in the handling of the complicated optical and acoustic equipment, and the constructive aspects of their mutual association. Each and every one of these elements merits encouragement and respect.

Without such support, projectionists may well encounter a succession of discouraging difficulties and disheartening setbacks. But given such support, projectionists may reasonably anticipate continued and increased respect, improved standing in the motion picture world, and the correspondingly increased financial returns which go to those who attain high standing through effort and enthusiasm.

Projectionists should never forget that, in addition to being the qualified manipulators of the specialized equipment of sound motion picture presentations, they are actually the stage managers of the motion picture theatre, entrusted with a real responsibiliy for the maintenance of public interest in and backing of the theatre. The best wishes of the far-seeing members of the industry go to them in their tasks and in the ever-continued growth of the craftsmanship and professional standing of their group.

DR. ALFRED N. GOLDSMITH

World-famous consultant, former professor of electrical engineering, City College of New York; ex-vice president, Radio Corporation of America; past-president, Society of Motion Picture Engineers; past-president, Institute of Radio Engineers and Editor of the I.R.E. *Proceedings*; one-time chief engineer, RCA Photophone, Inc.; holder of more than 90 patents pertinent to the electronic art, particularly anent television; honorary life member of I.A. Local 306, and honorary life member 25-30 Club of Projectionists.

Due to continuing severe paper limitations, certain material which was especially prepared for Section Two of this I. A. Convention Edition could not be included therein. Overall, this condition necessitated the omission from section two of more than 36 columns of editorial matter, some of which will appear in forthcoming issues of I. P.

NATIONAL

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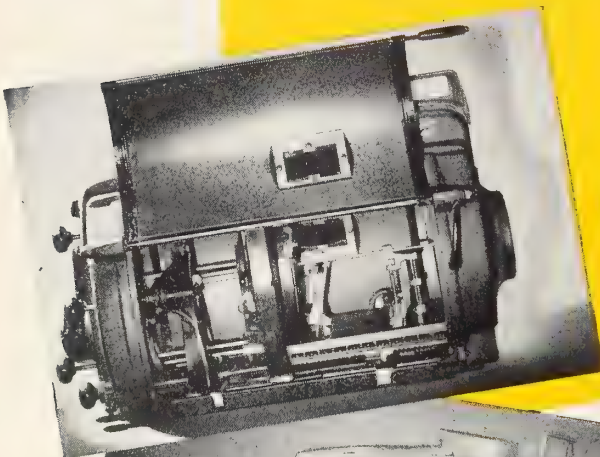

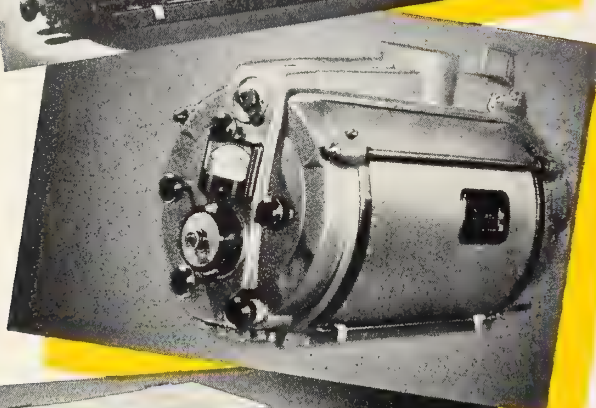

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"THERE'S A BRANCH NEAR YOU"

INTERNATIONAL PROJECTIONIST

VOLUME XXI JULY, 1946 NUMBER 7

The Retiscope Fiberglas Screen

By *PAUL BETHEL*

PROJECTIONISTS will soon be afforded an opportunity to use a new and unique motion picture screen the design and structure of which is based upon a revolutionary approach to the matter of an improved screen image. Occupants of seats over next to the wall will no longer have reason to complain of elongated figures on the screen, of eyestrain, or of echoing sound. The new Retiscope screen eliminates these hazards and provides every patron with an advantageous view.

The development of the screen stems from the idle curiousity, some 25 years ago, of a resident of Prague by the name of Otto Hehn. He placed a photograph in front of his concave shaving mirror and glanced at the reflection. Curiosity turned to genuine surprise when he noticed a surprising lack of distortion in the reflection, regardless of the angle from which it was viewed. Quick to realize the magnitude of the discovery, Hehn conducted a series of experiments on a new type of moving picture screen embodying the principal of reflection on a curved surface.

Extensive Research Program

A number of years later Hehn came to the United States hoping to enlist the aid of a moving picture expert in the development of his idea. In 1941 he was referred to Warren Millais, of Advance Research Corp., who developed the idea into the Retiscope screen as it is known today.

Millais plunged into years of experiment with new screen materials, various angles of projection, different screen sizes, and varying distances of throw. He realized that Hehn's idea of a curved surface would, if it were scientifically applied to moving picture screens, solve the problem of distortion that has always made the extreme right and left seats undesirable.

It was apparent at the outset that the different sizes of movie theatres would require different degrees of curve on the screen surface. Therefore the screen frame is constructed according to the size of the house, and mathematical calculations determine the degree of curvature required. The frame is then constructed to produce this curve when the screen is laced to it.

The Retiscope screen is composed of two surfaces: a sheet of Fiberglas stretched two inches in front of a second reflector sheet. Both sheets are laced to the screen frame. Light passes through the loosely woven Fiberglas onto the sheet of more tightly woven Fiberglas, enhancing whatever illusion of depth is inherent on the projected film. This eliminates screen lines and glare by diffusing and polarizing the light. It was also Millais' intention to add to the value of the screen by employing a screen material that is fireproof, washable, and immune to the assaults that youngsters in the first row often make with staples, tacks, etc. He achieved these things by experimenting, with Corning Fiberglas Corp., on a Fiberglas weave that was suitable to these needs.

Fiberglas is a coal-tar product that is fireproof. It is blown in huge hoppers and comes out looking much like the cotton candy bought at county fairs and on the countless numbers of boardwalks at the beaches. This filmy material is taken and is run through the same process as cotton, wool or other textile materials. It has terrific tensile strength, and showed no signs of damage even

Correct P.A. System Technique

By *M. K. STEPHAN*

MANY theatres are using some sort of live-talent show, either as an established policy or on occasions that require direct contact between management and the theatre audience. A variety of systems are in use, few of them good. Large theatres that use their stage for the presentation of live-talent shows usually have adequate sound reenforcing systems featuring many channels and high-level mixing. They are also equipped with a horn system usually installed in the sides of the proscenium arch. Since the microphones are seldom in front of the horns, acoustic howls are infrequent. These systems are the best that the industry offers and invariably give excellent results.

Another group of theatres do not use their stages, but carry on from a platform built on the orchestra pit and do all their work in front of the proscenium arch. All microphones are therefore in front of the horn system, and acoustic howls are quite common. Also, there is a very definite limit to the amount of amplification that can be used. As a consequence, the pick-up of the microphone is limited, and for satisfactory results the performer must talk close-up to it. This is the root of all evil experienced in this type of operation, but it is not generally recognized.

Horn, Mike Locations Vital

A modern microphone is a delicate and sensitive device. If used in an auditorium that is *not* equipped with horns, it is possible to obtain excellent pick-up from distances up to 100 feet, providing a sufficient amount of amplification is available. However, as soon as a horn system is placed in the same auditorium, the effective pick-up range of a microphone is reduced. The reduction is directly proportional to the coupling between horns and microphone.

The proper location of horns with respect to microphones is of paramount importance. However, a compromise usually has to be made. In general, it is imperative that the microphone be in back of the horns; in other words, the horns must be out in the auditorium and the microphone as far backstage as possible. If this is done, ample pick-up is assured.

If this ideal is not attained, however, results will fall short of anticipation, and we will have to work with a limited amount of amplification and its attendant evils. One of the evils is that operating in this manner imposes exceptionally heavy demands for amplifier power.

Taking an average auditorium where the microphone leads the horns by 13 feet, a net gain of from 90 to 100 db is all that can be used before acoustic howls occur. This means that performers must of necessity talk close to microphone for satisfactory results, a distance of from 6 to 12 inches being average.

What happens if the performer should decide to "mug"? The pressure on the microphone goes way up; its output goes up, too, and actually overloads the main amplifiers, even those having what would be considered adequate power-handling capacity. This overloading is at once apparent to the ear in the form of distortion, change of voice quality, and gives the impression that the horns have cracked diaphragms.

Typical Survey Results

A recent survey in an auditorium of 3600 seats was made to determine just what was happening in this respect. During an average feature picture the power demands on the final amplifiers varied from 7.5 watts average to 25 watts on peaks. On an average stage show (from in front of the proscenium) the average power requirements were from 12.5 to 25 watts, but peaks of from 50 to more than 100 watts were observed.

Now, then, in the auditorium checked, the picture channel had a capacity of 150 watts, whereas the P.A. channel had a capacity of only 50 watts. The surprising thing noted was the amount of power in the high-frequency spectrum, i.e., above 300 c.p.s. Since these are conditions as they prevail, what to do about them becomes the question. If no means can be found whereby the horns can be moved out in front of the microphone, the only alternative is to increase the capacity of the power amplifiers. One

(*Continued on page* 24)

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after pop bottles were thrown at it from a distance of only a few feet.

A theatre audience absorbs sound. In the past, as the theatre filled to capacity, a corresponding increase in volume became necessary. Likewise, as the crowd thinned, a decrease in volume was set. The fabric of the Retiscope screen allows all sound frequencies to penetrate at any volume setting. This tends to assure uniform sound reception regardless of audience size.

Light, Sound Transmission

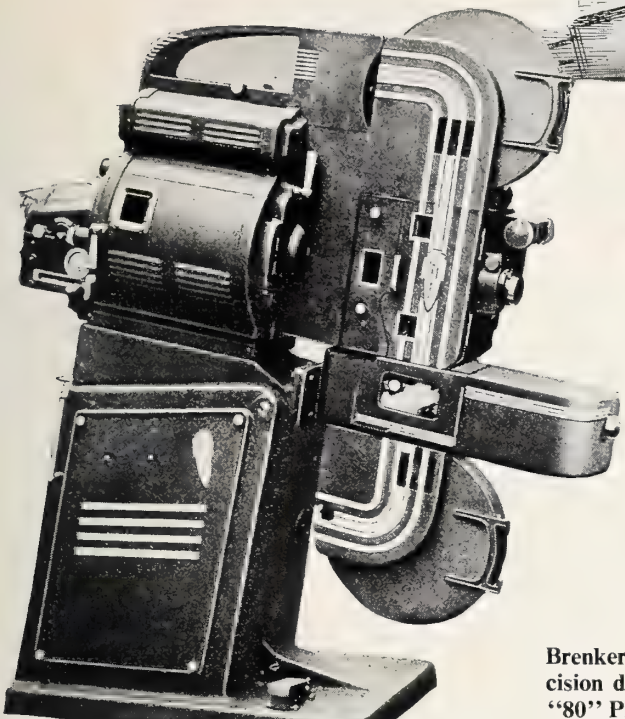
At the time the Retiscope screen was installed at the Hollywood Pantages Theatre, comparative tests were made on light reflectivity and sound transmission. Engineers returned a report that light reflectivity of the Retiscope screen was identical to that of the flat screen which it had replaced. Sound tests showed that sound transmission of the Retiscope screen was slightly less than that of the flat screen.

This screen was demonstrated to the writer who viewed the projected images from all angles. The improvement of this screen over those of the conventional, flat type was at once apparent. Distortion is non-existent even when one stands directly under the screen where the angle of sight is most acute. The effect is the same when the picture is viewed from extreme right and left—faces and figures are quite normal. The Retiscope screen is a great contribution to moving picture technique and it seems destined to exert widespread appeal. An additional advantage is that installation of this new screen does not necessitate lens change.

The Retiscope screen made a semipublic debut as far back as 1942, when the Pantages Hollywood Theatre held a premiere to demonstrate the screen to members of the press. All the major news services were invited, together with the drama editors of prominent West Coast newspapers. During the showing, the group was allowed to wander about the theatre to study the projection from all angles. The event was a tremendous success, and the screen received rave notices throughout the world. However, war news and wartime restrictions on materials served to make publicity impractical and manufacture virtually impossible, so the project has been held in abeyance until now.

Limited Current Production

During this lull, experiments were continued, resulting in even greater improvements to the point where the Retiscope screen is now in production. The first cities to benefit by the invention of this new screen are Hollywood, Cleveland, Bethesda, Md.; Charlotte, N. C., and the Naval Training Base at Treasure Island in San Francisco. Limited production facilities for the Fiberglas material at the present time will necessarily restrict the distribution of Retiscope screens for the next six months, but shortly thereafter this situation is expected to improve greatly.



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The Brenkert mechanism is the ONLY Intermittent Mechanism which is completely awash in the same circulating, filtered, oil stream which provides completely automatic lubrication for all of the projector mechanism parts.

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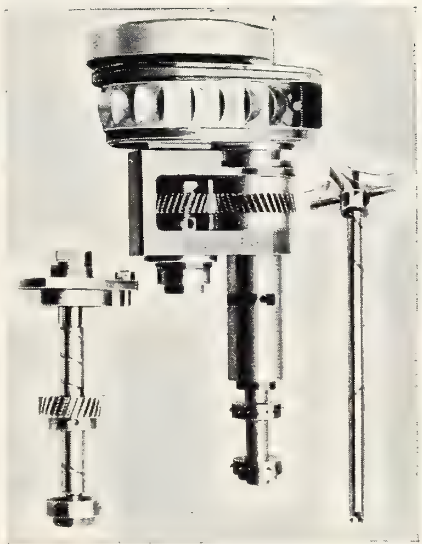
Brenkert intermittents are made with AN ACCURACY OF 1/10,000 OF AN INCH. These precise dimensions are maintained in operation by generous bearing surfaces and automatic lubrication. Note the long double bearing of the sprocket shaft, and the cam shaft; the hardened steel roller on the index pin; the generous size of the star and cam, presenting three to four times the bearing surface of any other intermittent. Brenkert precision is maintained by the MICROMETER ADJUSTMENT provided for the star and cam relation.

The sprocket is removed for reversal or replacement by the simple loosening of one screw, and without the necessity of removing the intermittent from the projector head. This means QUICK and INEXPENSIVE SPROCKET REPLACEMENT.



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Elements of Projection Optics

III. Another article in a series anent the fundamentals of projection optics

By *DR. ANGELO MONTANI*
CONSULTING ENGINEER, NEW YORK CITY

IN THE previous installment (I. P. May, 1946) we considered how the color correction of lenses is achieved. We will now discuss briefly other principal defects present in simple lenses. We emphasize the point that although all of these defects (âberrations) are all present together, for the sake of clarity we will consider them individually.

A very important defect encountered in lenses is "spherical aberration" which is not at all difficult to understand, although many individuals, even perhaps in the optical trade, do not have a clear perception of this phenomenon. Fig. 1a shows how the rays, this time all of the same color, originating from the left and entering the lens on different positions, form different focii behind the lens. In fact, the rays entering at the margin of the lens are refracted toward a focal point located nearer to the lens than the focus of the central rays.

This plurality of focii, corresponding to only one point of the same color, is called "spherical aberration." To correct this, a negative lens must be coupled to the positive one (Fig. 1b). By the proper selection of the indexes of refraction of the crown and flint glasses, together with particular curvatures of the surfaces, it is possible to obtain a composite lens corrected at the same time for both spherical and chromatic aberration (Fig. 1c).

This is the second instance in which we find the indication of a use for "negative" lenses. As a general rule, this last type of lens presents the same aberrations as does the positive type, but in the contrary sense. Therefore, when both types are used in conjunction, their faults are reduced.

Important Lens Aberrations

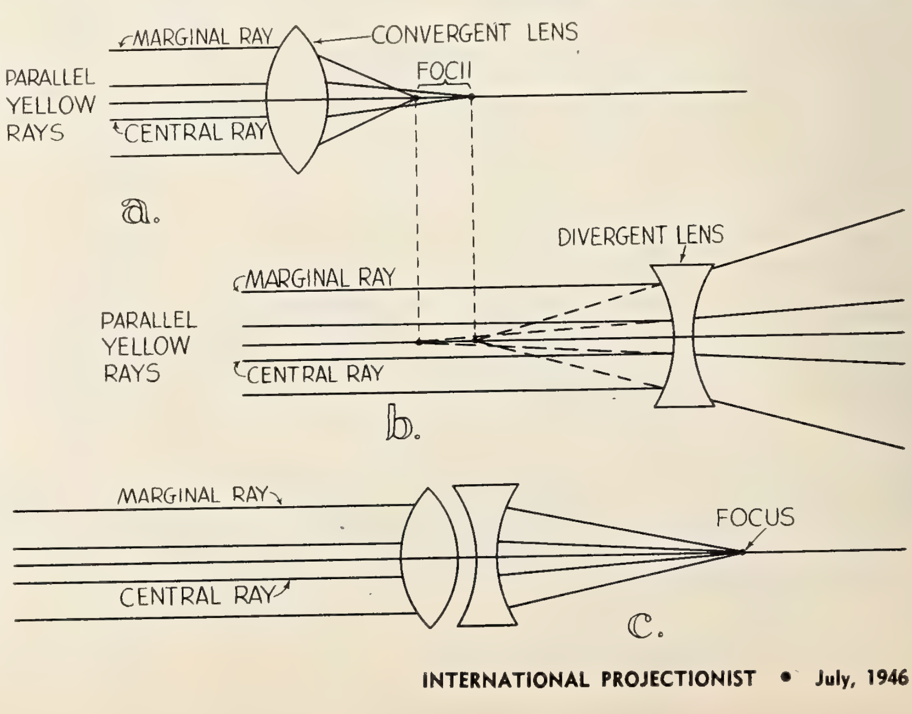
Another aberration is the "coma" which affects those portions of the image located away from the central area. If we project a picture through a lens affected by "coma," the image of a point located near the edge of the field will no longer appear as a point but as a segment of uneven thickness, or, more likely, as a straight typographic "comma" pointing toward the centre of the field.

The "astigmatic aberration" is one of the most complex aberrations to understand in its entirety and its consequences. We will limit ourselves in illustrating the peculiar deterioration introduced by it into the projected image. Let us assume that we are projecting a picture of a wheel with thin and straight spokes which fills up almost the entire screen. When the lens is affected by astigmatism, we will find two main focusing positions: first, the rim of the wheel is in focus; second, only the spokes near the centre are in focus.

Together with the astigmatism we would discover also another aberration called "curvature of field." This last defect forbids the sharp focusing of the whole image on the screen at the same time. By sliding the projection lens back and forth, we find that when the central part of the image is sharp, the edges are blurred; and when the edges are in focus, then the centre is blurred. The image would be sharp if the screen, instead of being flat, were curved so as to bring the frame nearer to the projector.

Finally, there is the important aberration termed "distortion." This defect is especially objectionable when the projected image contains straight lines supposedly parallel to the edges of the screen. Then the curvature of the projected lines is evident. Astigmatism and distortion are corrected by shaping the surfaces of the lens elements according to certain computing procedures and by introducing diaphragms.

FIGURE 1



Let us keep in mind that "astigmatic" means a defective lens; while "anastigmatic" means a lens corrected for that defect, and generally also for all the aforementioned aberrations. Any acceptable projection lens *must* be corrected for these aberrations.

Sometimes a corrected lens is also referred to as "free from aberrations." An explanation of this term is necessary. A lens is never completely free or corrected: the defects simply are reduced up to the point whre the eye is not aware of them. The lens designer tries to achieve this condition by the proper selection of the optical glasses, shaping of the surfaces, choosing the thicknesses of the elements, and spacing them. This complicated procedure, which always takes considerable time, is called "lens computing."

'Definition' of a Lens

A corrected projection lens is said to possess "good definition." Qualitatively, definition is the property of the lens to form on the screen a geometrically true image whereby the contours of the patterns are sharply defined. This holds true, of course, provided the picture is sharply photographed upon the film. A lens that, instead, projects hazy images is said to have poor definition and this may be due to either inherent design or accidental defects of a particular lens. Reflections between the elements may

also engender a lack of definition and "hot spots." This we shall later see when we return to the description of projection lenses and the elements comprising them.

At this time we should consider the effect of focal length on the size of the projected image. It is an experimental fact that if the focal length of the projection lens is decreased, the size of the projected image increases in proportion, provided the distance between projector and screen remains the same.

Figure 2 illustrates the manner in which this occurs. The lens in *b* has a focal length half the one in *a*, therefore the projected image is twice the width and twice the length of the *a* image. This means four times in area. Since practically the distance from the projector to the screen is generally imposed by the size of the auditorium, it becomes evident that in practice a particular value of focal length must be chosen to fill up the entire area of the screen.

To meet this need, lens manufacturers generally carry in stock lenses of standard focal lengths. These focal lengths increase in steps of a quarter inch from 3 inches up to 9 inches. In the old days when few projectionists were familiar with the so-called *f* number, they coined the trade expression of "quarter-size" and "half-size" lenses. This was a quick way to indicate the "speed" of the lens. On all modern projection lenses the *f* number is engraved just as is customary on photographic objectives.

Significance of 'f' Number

Concluding the second article of this series (I. P. for May, 1946) we explained the meaning of the *f* number. The smaller the *f* number the more light is allowed, therefore, to pass through the lens. If we set the speed (actually we should say the "luminosity") of a *f*/1.5 at 100, the following are the speeds for the larger numbers: *f*/2—50%; *f*/2.8—25%; *f*/4—12.5%. Larger *f's* are used in photography but seldom in projection work because of the poor light transmission.

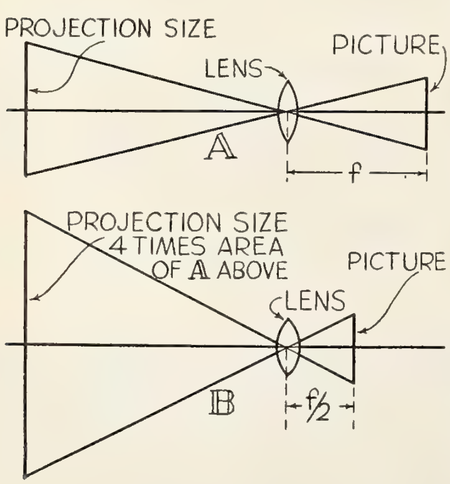


FIGURE 2

It has been customary to talk about the speed of projection lenses when the word "luminosity" should have been employed. The term "speed" derives from the photographic lens where it is used in a figurative sense. In photographic jargon a lens is "faster" than another lens when a shorter time of exposure is required to take a picture under the same conditions of illumination. In more precise terminology, the fast lens possesses a lower *f* number and therefore passes more light. It is evident, then, that the word "speed" when applied to a projection lens is a misnomer.

The luminosity percentages given here do not take in consideration the loss of light introduced by the reflection at the different air-glass surfaces (I. P., May 1946, Fig. 3). These surfaces in an ordinary projection lens can never be less than four and generally are six. The light reflected by the lens surfaces is wasted in terms of quantity of projected light. Additionally, the reflections among the inner surfaces of the lens elements may cause spurious beams of light which inevitably are transmitted to the screen thus diminishing the contrast and detail (definition) of the image (one of the causes of "hot spots"). Light losses of 40% are common in projection lenses. When the lens is not clean, the percentage of light lost may exceed 50%.

In the past six years it has been standard practice by American lens manufacturers to "coat" the lens surfaces. Lenses so treated are commonly referred to as "coated lenses." The low-reflectance lens coatings are metallic fluorides, the utilization of which is well known to I. P. readers. Suffice it to say that when the thickness of the coating is one fourth the wave-length corresponding to the frequency of maximum visibility, and the index of refraction of the coating is chosen so that equal reflection is obtained from both its surfaces (air-coating surface and coating-glass surface) then both reflections cancel each other, resulting in the transmission of more light through the lens. To determine whether a lens is coated, look at its reflection. If the reflection be purple, the lens is coated. Coating is more effective for a particular color.

Care of Coated Lenses

A coated projection lens may increase the screen illumination by 30% over the same type uncoated lens. This development is a "must" for every projectionist. A word of warning: several companies are equipped to do the coating, but not all of them know how to apply it and how to dissemble and reassemble the elements of a lens. If a lens has been reassembled incorrectly, then no degree of coating will guarantee optimum lens performance. Also, never try to clean a coated lens with a soiled cloth. Never touch the coated surfaces, because coatings, irrespective of advertising assertions, are very delicate and easily spoiled. Remember that the thickness is reckoned in fractions of *hundred thousandths of an inch!*

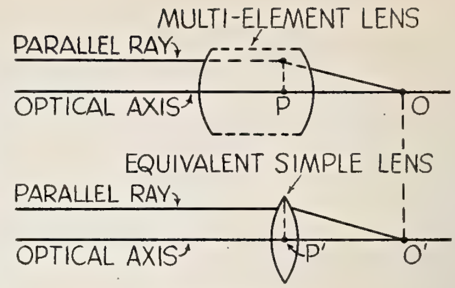


FIGURE 3

Up to this point we have considered focal length without making any distinction between simple and compound lenses. The focal legnth of a lens composed of several elements is more accurately referred to as the "equivalent focal length," represented by the letters E. F. L. sometimes engraved on the lens-mount. The equivalent focal length of a lens indicates that a lens has a focal length determined by the distance between an extremely thin simple lens of the same power and its focal point.

Figure 3 is a schematic representation of how the focal length of a multi-element lens is determined. The distance *P-O* is the focal length of a compound lens equal to the focal length P^1-O^1 of the "equivalent" simple lens. The perpendicular distance between the vertex of the outer surface of the last element and the film plane situated behind the projection lens is called the "working distance." This distance is always slightly greater than the "back focus." It would correspond to the "back focus" only in case the projected image were aimed at a screen positioned at infinite distance, because in that instance all the rays coming from a particular point of the picture would be parallel after leaving the lens.

RCA Expands 16-mm Program

RCA has increased its production facilities for 16-mm sound film equipment and transferred its activities in this field from the company's Indianapolis plant to Camden, N. J. The company's program encompasses the production and marketing of a complete line of 16-mm sound film projectors, styled to meet the needs of educational, industrial, religious, civic, and roadshow organizations. RCA will also sell a complete line of 16-mm accessories and auxiliary equipment, both at home and abroad.

A national merchandising organization of specialized 16-mm sound film equipment dealers, with on-the-spot service facilities, has been set up by RCA from coast to coast.

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Video and the Somnolent Cinema

By *FRANK WALDROP* and *JOSEPH BORKIN*

Prophetic indeed was a book published in 1938 which discussed the impact of an expanding electronic art upon the motion picture industry†, with particular emphasis on the relation of television to the movie theatre as presently constituted. The accompanying article, one chapter in this book, is no less persuasive today than it was eight years ago in assaying the position of the film industry with respect to the anticipated early introduction of large-scale commercial video.

† *"Television: A Struggle for Power," by Frank Waldrop and Joseph Borkin, published by William Morrow & Co., New York, 299 pages, with appendix, index and bibliography, $2.75.*

TELEVISION eats up large areas of the spectrum to the starvation of other radio services, but that is not the end of its ravening. It threatens to swallow whole industries. Radio set manufacturers will have to transform their technique of production so that they become television set manufacturers. Radio broadcasters must become television broadcasters.

The radio set manufacturers, and the broadcasters who found the commercial band of the spectrum a vein of virgin gold, have recognized full well the danger that confronts them. In regiment formation they have bombarded the Federal Communications Commission to consider their interests as television approaches. They experiment, make treaties among themselves, and offer plans for protection. They might be called sprinters, crouched for the starting gun in a race that will end in fame and fortune for somebody.

But among the contestants we see an unwilling fat boy trying to assume the angular position of the ostrich with head in sand. That, in a word, is the way the motion picture industry is behaving as television comes.

The bulk of television programs will probably be in the form of motion picture films. For one thing, films are more easily televised than stage performances and have proved so successful that in the present experimental period more than sixty per cent of the broadcasts are from films. Apart from mechanical perfection there are other considerations. The film story technique lends itself naturally to television; and so does the scenic perfection that the motion picture industry has developed.

Movies' Unpreparedness

But television has a voracious appetite for material. If it comes to operate on a time schedule equal to that of present commercial radio, the present annual production schedule of films will not maintain service for more than three months. To keep up with such a pace the movies will have to undergo radical changes. Present production schedules, if quadrupled, still would not meet the demand.

But even if the supply of entertainment can be kept up, the movies may still be reduced to a minor vestigial program service unless a sound bargaining position is established for them. Having undergone one radical change in ownership and financial structure because of unpreparedness, the movie moguls ought by now to be alert to technical change and its threats, but, alas, they seem not to be.

At present the motion picture industry is in two distinct though not entirely separate branches, each dependent upon the other. One branch is concerned with the production and distribution of pictures (Hollywood); the other with exhibition (America). Hollywood concerns itself with studio operation, photography, sound recording, the selection of artists and plots; in a word, with picture creation. Production could go on in a television era, only speeded up or slowed down to meet demand; and nobody outside Hollywood, except those holding stock in movie companies, would know or care.

Chain Growth Intensified

The exhibitors simply put the finished product before America today and try to ward off the headache which is surely going to overtake them with the advent of television. It would appear as though, when the new consumers are available at the studios, the producers may be in a measure freed from their dependence upon the exhibitor to whom they have had to cater for so many years; but actually the television broadcaster is merely substituted for the exhibitor.

The movie moguls have always been the victims of a mania for, and a complete failure to attain, independence. Before the advent of sound they used their fresh and copious profits to create exhibition outlets of their own wherever possible. Some of these remain today.

One of the first ventures into both sides of the market was made by William Fox, a furrier turned nickelodeon operator, who acquired a producing company to guarantee his theatres films for exhibition. Fox is a rare character and one of those who make this story possible, for he not only bound production and exhibition together, but overlaid both with sound and banknotes.

At the advent of sound, Fox intensified the chain movement of theatres by pushing the industry into the new technique so that it had to be assured not only of actual distribution of product. but also of equipment in theatres to reproduce programs in a manner becoming to the super-colossal empire that Hollywood conceived itself to be. On the practical side it was recognized that the movies could not go on half silent and half sound. Events and schemes pressed the moguls finally to choose sound.

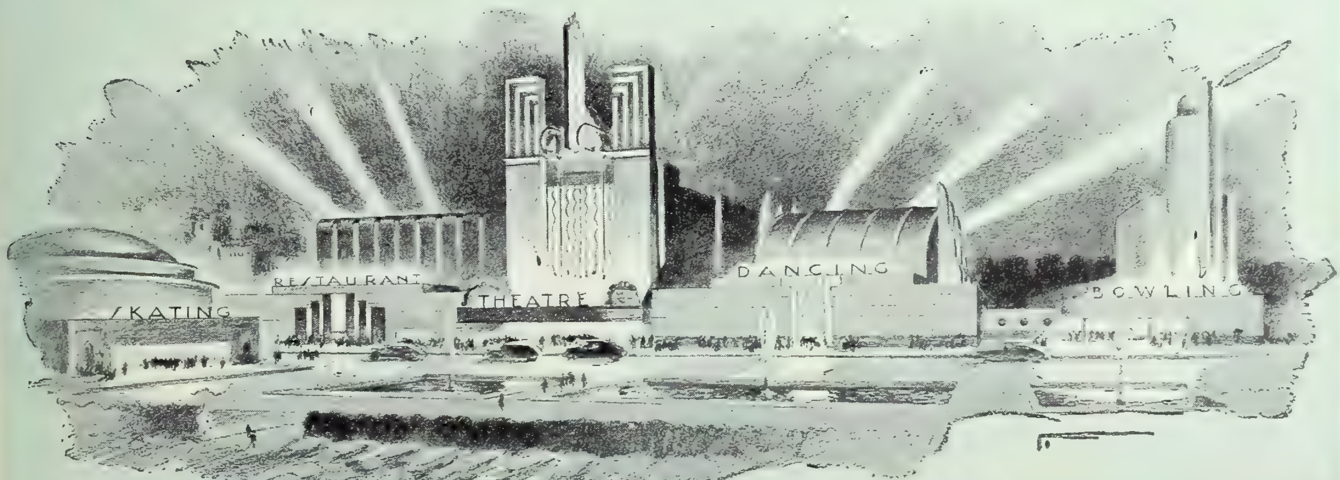
The arrival of sound movies smashed the structure of such leading companies as Fox, Universal, Paramount, and Radio-Keith-Orpheum, and made them the vassals of bankers. Famous actresses and actors became as obsolete as wooden plows or handmade shoes. Theatre orchestras vanished into picket lines; and the legitimate theatre became an appendage. Today those few actors who refuse the Western adventure find themselves cast in productions which are conceived, designed, and maintained in the sole hope that some film company will take an option on them.

Film Theatre's Future

Is it inconceivable that the next step in the theatre's metamorphosis is a vestigial movie house in which to test public reaction before the great exhibition to the nation by way of the radio spectrum? Will the motion picture theatres occupy the present situation of the legitimate theatre? To determine such questions as these the motion picture industry maintains an institution known as "The Motion Picture Producers and Distributors of

(*Continued on page* 20)

Vertical carbon arc lamps were usually employed in the theatres of the early 20th Century. Shown is The Cascade, Newcastle, Pennsylvania, in 1903. (Illustration from "Stages Through the Ages" by Harry H. Strong).



THE THEATRE OF TOMORROW

IN THE SPOTLIGHT

By *HARRY SHERMAN*

SEVERAL months ago the Brotherhood of Railroad Trainmen issued a statement which said in part, "The Congress of the United States has just ended a year of legislation for the greedy in a fresh burst of anti-labor hysteria." Some unthinking people will say, of course, that this statement is partisan because it comes from a labor union. Upon reflection, however, any fair-minded person who noticed the speed with which Congress enacted the law repealing the excess profits tax on business and the anger with which it passed the anti-labor Case bill, will admit that the Brotherhood of Railroad Trainmen had good grounds on which to base their remarks. No such speed was shown by Congress when the unemployment compensation or the minimum wage bills were up for discussion.

Daily on the floors of Congress one can hear many of our representatives exclaiming in Claghorn style that organized labor is participating in a "minority-monopoly form of violence," or that the Federal government is "coddling and encouraging labor gangsters." Some of our legislative representatives spout off proposals to the press that would ham-string labor through compulsory arbitration, revise the Wagner Labor Act, subject labor to civil damage suits, 60-day cooling off periods, etc. It would not be amiss for these legislators to brush up a bit on the history of labor unions in this country—how they came into being and their effect upon the American way of living.

Less than 100 years ago the courts in this country convicted workers for engaging in what they termed "criminal conspiracies" merely because they banded together to improve their working hours and conditions. Although in 1842 a judge in Massachusetts held that trade unions were not illegal, many courts issued injunctions against them, thereby making union activities unlawful. As a matter of fact, "Government by Injunction" was the rule until the passage of the Norris-LaGuardia Law in 1932.

Organized labor met with bitter opposition from employers at the very outset. It was against this opposition that the labor movement of the early 19th century conducted militant strikes for higher wages and a shorter work day. Labor's economic program was supplemented by political action.

Following World War I conditions were ripe for a rapid growth of labor organizations in the country. The cost of living had skyrocketed. Well planned movements were on foot to organize employees in the various industries. If these organizing drives had succeeded, the large body of unskilled and semi-skilled workers in the basic industries would have enjoyed the benefits of collective bargaining that much sooner, and the labor history of the 20's would have been different.

As it was, however, many American employers refused to accept the principle of collective bargaining with labor unions, but instead launched a vicious open-shop campaign with the object of weakening, if not destroying, existing labor organizations, while preventing the extension of unionism to the most exploited group of workers in society—the unskilled. In 1933 organized labor's membership fell from a high of 5,047,800 in 1920 to a low of 2,973,000. This decline in union labor membership strength was reversed under the New Deal. Today there are approximately five times as many men and women enrolled in labor unions as there were in 1933.

Labor is proud of its war record, and justly so. A few days after the attack on Pearl Harbor the leaders of labor pledged their organizations to maintain a no-strike policy for the duration. That pledge was fulfilled practically 100%. The number of man-days of production lost on account of strikes during the war averaged five one-hundredths of one per cent in 1942; fifteen one-hundredths of one per cent in 1943; nine one-hundredths of one per cent in 1944, and forty-two one hundredths of one per cent in 1945. Despite the squeeze between a wage freeze and mounting living costs, and the numerous provocations on the part of management, labor remained on the job.

Against the men and women on the production line was leveled the false charge of absenteeism. Paid advertisiments appeared in many newspapers charging labor with hamstringing the war program by insisting upon time and one half for overtime while the boys in the foxholes were fighting for democracy at straight time GI rates of pay. This propaganda was but one of the many smoke screens thrown to cover up the undisputed fact that a great deal more time was lost as a result of sickness and industrial accidents than through the soldiers of production going a. w. o. l.

There may be some who profess ignorance as to what the unions are fighting for. So let us tell them in no uncertain terms that they are fighting to preserve hard-won collective bargaining rights. Fighting to maintain and improve living standards for the organized and unorganized. And last but not least, they are fighting to strengthen the purchasing power of the American people—which includes everyone—so that our economy will not bog down into another depression. American labor is fighting for America. For Congress to take the opposite side, by adopting hastily conceived, ill-advised legislation to shackle labor organizations, is the first step in the direction of national chaos. One such stupid law was the Smith-Connolly Act. Shall we have another?

It was in 1882 that the railroad magnate, William H. Vanderbilt, answered an interviewing reporter who had asked about the public's interest in transportation with the famous statement, "The public be damned." This seems to be pretty much the sentiment that prevails in certain quarters these days.

● In 1940 all I. A. local unions in the state of Oregon joined forces in an effort to enact state legislation to make compulsory that all theatre projection rooms be equipped with sanitary facilities and proper ventilation. Their efforts at that time were only partially successful as the bill, when passed, applied these measures only to new constructions. Recently, Harold De Larm, secretary of Eugene Local No. 675, started a new campaign

to extend the aforementioned facilities to all theatres, old as well as new. The success of De Larm's campaign depends upon the cooperation extended by the other I. A. locals in Oregon, for it is only through their *combined* efforts that their aims can be achieved.

● Score another scoop for Gene Atkinson, business manager of Chicago Local No. 110! A signed contract with Chicago television station WKBK, bringing it under the jurisdiction of the I.A.T.S.E., is Gene's latest triumph. Under this agreement station WKBK is provided with the following personnel: one Local 666 cameraman, $132 per week; one Local 110 engineer, $132 per week; and one Local 2 stagehand, $100 per week. These salaries are based on a 40-hour work week, with proper compensation for holidays, overtime and doubletime. Additional personnel will be added when the station commences daily broadcasts.

Gene Atkinson

We are happy to congratulate Gene on his initiative in signing up this television station, and we hope that other union officials in cities where there are television stations will follow suit. We have long contended that all television stations rightfully come under I. A. jurisdiction.

In addition Gene obtained a contract from the operators of the non-coin Soundies whereby Local 110 projectionists will supervise installations at the rate of $150 per 40-hour week, plus expenses outside the Chicago jurisdiction. He also reopened the existing contract with Ideal Pictures Corp. (16-mm outfit) and successfully negotiated a new contract calling for an 8-hour, 6-day week at $100 per week, plus 7¢ per mile for portable assignments. Also, a contract was signed with the operators of the Sportman's Park in Chicago calling for the employment of the projectionist from Local 110 to show photo finishes and post stills for $110 per week, and $100 per week for a member of the Laboratory Technicians Local 780 to process the film.

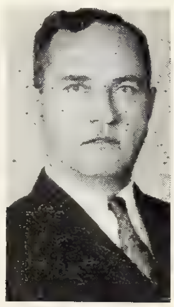
During the dimout period, from May 3 to May 10, when all theatres in Chicago closed down on account of the coal strike, Atkinson went to the bat for his members with the result that they received full pay for the entire period. This puts us in mind of the elevator strike in one of the large cities when the union officials insisted that members working in a studio projection room situated on the 17th floor of an office building CLIMB 17 flights of stairs to their jobs, or else forego their salaries. We would hardly call that going to the bat for your men!

● Many years ago an attempt was made to put compulsory arbitration on the statute books of this country, and the fight that organized labor put up to defeat that effort is history now. Certain forces in this country are again trying to make compulsory arbitration a national law, and once more organized labor is marshalling its forces to defeat the measure.

● Twenty-one years ago this month (July 27, 1925) William F. Canavan, then president of the International Alliance, appointed yours truly I. A. assistant president. Besides Canavan and the writer the only other members of the 1925 official family still holding office are Wm. P. Raoul, now general secretary-treasurer; Wm. P. Covert, 2nd vice-president; and Wm. C. Scanlan, trustee.

● We lost another old friend in the passing of William (Bill) Estes, charter member of Dallas Local No. 249, who died last month after a lingering illness. Bill had been employed as projectionist at the Majestic Theatre for over thirty years, and was one of the most popular members of the local. He is survived by a son, Randall, former Air Force pilot and also a member of the Dallas local.

● A joint agreement between Canadian Famous Players and Toronto Local No. 173 is now before the Labor Board for approval. This agreement, which was negotiated for the Toronto local by its business agent, William P. Covert, calls for an immediate 4% wage increase retroactive to September 1, 1945, an additional 3% increase beginning September 1, 1946, and a further increase of 3% beginning September 1, 1947. It also calls for a one-week vacation with pay for Local 173 members working for the company less than five years, and a two-week vacation with pay for those members with five or more years of service.



Wm. P. Covert

Men working in the downtown shift houses will receive $71 for a 33-hour week, and men working the night houses will receive $51 for a 27-hour week; two men per shift in each of these houses. The overtime rate for shift houses to be $3 per hour, and $2.65 per hour in the night houses.

Incidentally, Covert, who is also 2nd International vice-president, was recently re-elected business agent of the local for another three years, thus in 1949 he will have served as an officer of Local 173 for 41 years.

● Sam N. Bonansinga, secretary and business agent of Springfield Local No. 138, is a candidate for the office of vice-president of the Illinois State Federation of Labor. Sam has played an active role in labor circles for over 30 years, holding office in various labor organizations. He is a member of the Civil Service Commission and Social Service Exchange, and for many years held the office of president of the Springfield Federation of Labor.

Sam Bonansinga

During the recent war he was appointed member of the War Manpower Commission, represented labor on Appeals Board No. 12 of the Selective Service, and served as a director of the Springfield War Fund Council. We believe that Sam's imposing labor record over the past years warrants the backing and support of every I. A. delegate to the forthcoming Illinois State Federation of Labor Convention.

RCA Drive-In Equipment

RCA's combined terminal box and speaker receptacle Drive-In unit is so designed that a short-circuit in the speaker unit or cord can affect no more than the two speakers connected to any one terminal box. This permits all other speakers to continue normal operation in case of trouble in any one unit, and facilitates location of the trouble. Formerly, a short-circuit in even one speaker could put a whole line of speakers out of operation until the trouble could be located and corrected.

The new type neoprene-covered extension cord is 16" long in its retracted form, and can be stretched to about 4½ ft. with a pull on the speaker unit of only 1½ pounds. If necessary, this cord can be stretched to a maximum of aprpoximately seven times its retracted length, or about 9 feet. Since the cord covering is treated with a "sun-proofing" wax, it can be exposed to the hot sun over long periods of time without deterioration.

A feature of the new RCA drive-in sound system is an arrangement for keeping the sound level constant regardless of the number of speakers in use, once the line volume has been adjusted. The tubes used in the new amplifier system cost less than one-half as much per watt output as tubes used in prewar systems. This sound system reduces materially the cost of operation.

World Markets for American Motion Picture Equipment

By NATHAN D. GOLDEN

Motion Picture Advisor and Consultant
Office of International Trade, U. S. Dept. of Commerce

WHAT are the future possibilities for the motion picture equipment manufacturers? Can they win new foreign markets for their products which are known the world over for their superior quality? At the outset, it must be admitted that American manufacturers in this field have just gone through five of the most lucrative years in their history. Their source of profits, however, has been largely the Government. Abnormal amounts of equipment have been required to meet the needs of our armed forces. For motion pictures have followed our troops around the globe, playing an incalculable role in maintaining the high morale of the men and women in all branches of military services.

During the war years normal trade was decidedly limited. Theatres and studios had to get along with equipment purchased before the war. The theatres' uninterrupted functioning has been due in large part to the extraordinary job done by the American motion picture projectionist. Thanks to his ingenuity and skill, equipment was kept in smooth working order; without him, many a theatre would have been forced to close.

Today, however, the scene has changed. Uncle Sam's needs are steadily declining. But manufacturers of motion picture equipment are being besieged with orders from private business. Theatres from Maine to California anxiously await replacements. As a result, it is safe to say that equipment manufacturers will enjoy their wartime type of prosperity at least for the next few years. But they will want to maintain their same high production and employment levels when the home demand inevitably slackens. What then?

Foreign Theatres' Needs Critical

The obvious answer is to turn to world markets. But to realize fully on future possibilities, it is necessary to lay the groundwork today. In comparison with domestic needs, those of foreign theatres are far more critical. In the majority of cases, the equipment is of foreign make and generally not up to American standards.

In the past, foreign-made motion picture equipment has predominated in the theatres of Europe, the Far and Near East, Africa, and in most of Latin America. In addition to lower prices, foreign producers have offered longer credit terms than have American firms. The present condition of this equipment is obvious when it is realized that the major suppliers were Germany, France and England. When those countries went to war, their normal flow of supply parts and replacement equipment for export, of course, stopped.

According to reports, projectors in many foreign theatres have been kept in operation only by resorting to the most crude, makeshift measures. Replacement parts had to be made by local machinists; the projectors themselves were often held together by wire. This wartime experience has served to convince many of our world neighbors in the motion picture theatre business that it is more economical in the long run to buy quality equipment. They have had ample proof that the advantage of a lower initial cost of German-made products, for example, is quickly offset by its shorter-lived usefulness. It is only natural, therefore, that they now look with keen interest to the United States for replacements they must have.

The question is—How can both the home and foreign markets be satisfied? Certainly the needs of American theatres deserve first consideration. By the same token, however, the far-seeing American manufacturer cannot completely ignore the demands from abroad. They cannot, will not wait until the home market is satisfied.

Well-Rounded Program a Requisite

Taking a tip from the plans of many other industries, the motion picture equipment producers might well consider a system of allocation. In other words, they might set aside a definite, if far smaller, portion of their total production for export and thus pave the way for an expanding trade abroad when they will really need it.

But providing for such entering wedges in world markets is but one of several steps that must be taken if overseas trade is to pay dividends in the long run. While foreign trade is in no way mysterious, it does require faithful adherence to the best methods of merchandising and selling—American methods. It also requires certain knowledge that does not enter into domestic commerce. For instance, the exporter must become familiar with exchange, duties, consular invoices and various regulations on packing and shipping.

But first of all, it is essential to analyze the particular market or markets that appear worthwhile. The motion picture equipment manufacturer will want to know what our export in his particular type of equipment has been. He will be equally interested in learning the demand in certain countries, and whether foreign producers are getting running starts in those markets. And if the field seems open, the wise American manufacturer will investigate the general economy of the country he wants to enter. Is there a sufficient amount of dollar exchange to pay for his goods? What about transportation, and the various financial aspects, such as credit and collections,

The answers to these questions and many more needed

● Box-office-minded managers of theatres, large *and* small . . . in every state . . . are changing over to Simplified High Intensity Projection. Why? Because it makes a big *and most favorable* difference on the screen —and on the audience too. Yet, in spite of its vastly superior advantages, High Intensity Projection costs little, if any, more.

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for intelligent market analysis are readily available from the Office of International Trade of the Department of Commerce, or the Field Offices of the Department. In this connection, special reports are available on the market potentialities for motion picture equipment in certain foreign countries. These reports are published regularly in Part III in the Industrial Reference Service. Twenty-seven were completed last year; 11 so far this year. Each of these studies gives the current situation in a particular country on theatre equipment, including projection and sound facilities, arc lamps, accessories, motor generators and rectifiers, curtain tracks and machines, and air-conditioning equipment. Also covered are the hours of operation, and demand for studio equipment and non-theatrical equipment for schools, commercial firms and amateurs. In addition to the better-known markets, Iceland, Palestine, Bermuda and other small countries have been surveyed and reported on in this series. Another source of up-to-the-minute data helpful to exporters is *Foreign Commerce Weekly*. This Department of Commerce periodical carries a department entitled "News by Countries" in which late reports from Foreign Service officers are published. These contain valuable information on tariffs and trade controls, new industrial developments, the general business situation, and laws and tax information.

Vast Array of Data Available

It is impossible for the Office of International Trade to publish all the facts and figures it collects and studies. But the office of the Motion Picture Advisor and Consultant and the Foreign Trade Statistics Division of OIT are able to answer practically any specific request for material not available in printed form. For example, basic world trade data sheets are compiled by the Trade Statistics Division. In the motion picture field, figures cover motion picture cameras, sound equipment, both recording and reproducing, arc lamps, motion picture screens, and various miscellaneous items under motion picture projection.

And over the years, the office of the Motion Picture Advisor and Consultant has collected a vast array of economic facts and is constantly in touch with current conditions through the Foreign Service officers of the United States. These officers, stationed throughout the world, report all manner of business facts, none more important than the local credit and collection situation. In combination, this highly varied service of facts and figures will answer practically any informational need for foreign market analysis.

But once the markets have been systematically analyzed, equal care must be used in planning the actual operation of exporting. In other words, the human element of trading abroad must be just as carefully weighed as the economic aspects, if success is to follow. The ideal type of foreign representation, of course, is a branch office of the parent company with its own staff of salesmen, repairmen, technicians, etc. Unfortunately, this is too expensive for the manufacturer of moderate-priced equipment operating on a relatively small scale. The next best thing is to appoint an agent. The sole source in Government for information on foreign business representatives is the Commercial Intelligence Division of the Office of International Trade. Such information is contained in Trade Lists which are maintained by industries, commodities, or services for all of the world trading areas.

There are lists, for example, covering the motion picture industry in various countries. Included in these are film and apparatus importers and dealers; motion picture distributors and exchanges; motion picture apparatus and film manufacturers; motion picture film producers; and studios, laboratories and free-lance motion picture cameramen. While these lists on the motion picture industry

STRONG ELECTRIC CORP. MARKS PRODUCTION OF THE 25,000TH STRONG PROJECTION ARC LAMP

New lamps for old. James Beidler, of the Smith & Beidler theatre chain of Toledo, Ohio, returns Strong projection arc lamp No. 1 and presents it to Harry H. Strong, president of Strong Electric Corp. This lamp, a low-intensity model, was installed 25 years ago in the East Side Auditorium Theatre in Toledo. Accepting the lamp, Mr. Strong thereupon presented Mr. Beidler with Strong lamp No. 25,000, a gold-finished, high-intensity model, along with another lamp of the same type.

200 years of lamp building! This is the sum total of the time devoted to the production of projection lamps by these men. Shown here, left to right, are Leo Altenbach, foreman; Lee T. Nelson, auditor; Charles A. Tuttle, superintendent; Berlyn Perrine, shipping; Harry H. Strong, president; John Adams, in charge of the finishing department; Robert Corl, chief engineer; Willam Groh, machinist, and Frank Kneisley, in charge of the tool room, who worked on lamps Nos. 1 to 25,000 inclusive.

Presenting: Sam Picinich

BY THE bayous is a fellow who has been in the motion picture business for 30 of his 47 years and has served his Local Union for more than 25 years. His name is Sam Picinich and, first elected to office in New Orleans I.A. Local 293 in 1921, he seems destined to be Treasurer of this unit in perpetuity—a most fortuitous circumstance.

Sam's talents far exceed the mere collecting, safeguarding and judicious disbursement of Local funds: he believes in making the boys' money work for them to the end of bettering their security and general welfare. Sam's first major chore for the Local was the setting-up of a new method of bookkeeping, the facilitating of the system of reports to the I. A. General office, and a simplified system of dues collecting.

This much having been accomplished, Sam gave full play to his humanitarian instincts and proceeded to devise and put into effect the Picinich Insurance Plan on a basis that would aid every Local 293 member. This plan, adopted in 1932, originally provided every member with $1000 life insurance, plus $10 weekly for sick relief. To make the plan self-supporting, Sam established a Loan Fund wherein any member could borrow up to $100 at legal interest rates. So successful has been this plan that the insurance has been increased to $2100 per member, the sick relief sum to $15 weekly, and the loan privilege to $200. Through the years the plan has clicked. Sam saw to that.

We often hear about guys with "hearts"—usually applied to large-beamed, expansive-natured fellows who like most everybody and are well liked in turn. Sam Picinich doesn't quite match the aforementioned specs, probably because his humanitarian impulses, disdaining the hearty voice, the full-face smile and the sturdy cuff on the back, actually come from the region of the ventricles. A perfect guy, this Sam Picinich, ay?

Hell, no. Sam is brazenly conducting four love affairs right out in the sight of everybody. This seductive quartette includes the Deep South, the city of New Orleans and environs, the Picinich family, and a gal with the inclusive name ot Beauty who is compounded of one part music and one part rare flowers.

Sam's family is really something. Mrs. Picinich he found amid the settings of a music school where they both were pupils, Sam's chief aspiration up to that time having been the mastery of the violin. Sam's son, Marion James, 23, received his M.D. degree from Tulane University on May 15 last; while Loretta Gladys, 21, is an accomplished musician.

On July 10 Local 293 celebrated its 33rd anniversary with a dinner dance at which time Sam Picinich was tendered a fitting token in appreciation of his long and fruitful service to the organization. Of course, Sam really beat his brothers to the punch on this one, for down through the years his biggest reward has been in the actual doing of those things.

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cover practically all foreign markets, most were issued in 1939. Some covering Latin American countries, however, were prepared as late as 1944 and 1945. From these lists, the equipment manufacturer can enter into correspondence with firms or individuals that seem qualified to represent him. Then when expressions of interest have been received, he can check further through a World Trade Directory report, also maintained by the Commercial Intelligence Division. Here he will find summarized all the important facts about a businessman's or a firm's operations, facilities and general reputation.

In considering the all-important problem of sales representation, it is well to remember that an agent should not be expected to cover too much territory. Most foreign countries divide themselves into definite sales areas, each of which merits separate representation, unless one agent has branches which insure adequate coverage. At any rate, each agent should be given exclusive jurisdiction and confined to a given territory.

It is well known, of course, that conditions in Europe and many other world markets are seriously upset. Because of this fact, American equipment manufacturers should consider carefully the advisability of emulating the American motion picture film distributors by forming an export corporation under the Webb-Pomerene Act. Under this Act, firms may unite as a cooperative merchandising group for the sale of their equipment in foreign markets. Through such cooperative pooling of forces and funds, it is possible to operate foreign branches with salesmen traveling through each area. The advantages of this type operation are threefold:

First, the hand-picked representatives would acquaint theatre owners of the existence of their branch office and of the expert services available. Second, they would carry on a program of education for the foreign projectionist. And third, there would be at all times in the branch office a sufficient stock of spare parts and equipment to meet emergency needs of repair and replacement. Certainly when these advantages are well planted in the minds of the foreign exhibitor and the projectionist, sales resistance will be minimized. The personal contact of factory representatives—an important objective of operation under an export association—has proved to be a very effective means of selling various types of American goods abroad. It would seem that success might be enjoyed by motion picture equipment manufacturers operating in this fashion.

But whatever methods are chosen, this particular industry will find markets around the world that are anxious to buy its products. Countries of Latin America, the Far East, Near East, Africa, and even Europe now offer important outlets for American motion picture equipment of all types. Exhibitors in the Far East, Australia, New Zealand, and the Philippines already have a healthy appreciation of the quality and performance of our projection equipment. The same confidence is found in many of the Latin American markets. But in the Near East and Europe, where products of European manufacture have long predominated, intensive and intelligent selling methods will have to be employed. The time is now ripe.

Thus the possibilities for winning new foreign markets are exceedingly bright. Theatres throughout the world have never enjoyed a more important position than today. They have been among the first business projects to be reestablished in the war-torn countries. As more and more of them are reopened and new ones are built, the demand for up-to-date equipment will zoom. If U. S. manufacturers are alert to their opportunities and start planning now to take full advantage of their strategic position, their equipment should girdle the globe.

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VIDEO AND THE CINEMA

(*Continued from page* 12)

America," headed by Will Hays[1], who was Postmaster General of the United States during the administration of Warren G. Harding.

In 1936 Mr. Hays hired A. Mortimer Prall to make a study of the relation of television to the motion picture industry. Upon learning that this research student was the son of the late Anning Prall (who was then chairman of the Federal Communications Commission, which also had the problem of television under study at the time), one recognizes the astuteness of the "Czar of Hollywood".

Mr. A. Mortimer Prall, in a highly confidential document entitled "Television Survey and Report," advised the movie people that television opens a new and extremely important field for the industry. He pointed out that three times the amount of film they produced would be necessary for television.

Tele Film Requisites

In addition, "the motion picture industry is composed of great production corporations. They possess every element necessary to the production of the finest programs of sight and sound on film. Writers, composers, artists, designers, architects, engineers, technicians, construction men, studios, special equipment and the world's best actors and actresses are all a part of this industry . . . It is clear that the motion picture industry is the only source of supply for television programs."

Two plans were suggested in this report. One was that the present producers apply to the Federal Communications Commission for permission to buy up one of the existing radio chains such as National Broadcasting Company, the Columbia Broadcasting System, or the Mutual Broadcasting System. The other was that the motion picture industry buy up stations not now in one of the four major networks and form a fifth radio chain. That too necessitates application to the Commission for license. In other words, he suggested that the motion picture industry engage in the business of radio with the sanction of the Commission of which his father was chairman.

There are several obvious faults in this plan. Sound radio is certainly a step towards television. But it must be recalled that television will play in the upper strata of the spectrum. There is, of course, no guarantee by Mr. A. Mortimer Prall that the Commission will give the movie industry frequencies for television when the day for commercial ex-

[1] Now the Motion Picture Association of America, eaded by Eric Johnston.

ploitation arrives. It could happen that the movie industry would find itself with two very large and moribund white elephants—the present motion picture studio and theatre system, and the sound radio system as well.

Is the exhibitor to be left to his fate by Mr. Prall? This is an important consideration, both for the producers and for the little men with neighborhood theatres. Because of their large investments in exhibition chains it would be suicidal to their capital structure for the great producing systems to allow their theatre investments to crash. But however we may pity them we have to ask what incentives there will be for a customer to drive his car, run or even walk to a movie house when his own living room may become a theatre; and we can think of none that seems valid.

Maybe there are reasons why the movie palace will last despite television. One argument has been advanced to the effect that the theatre will remain as a place of assembly because man is naturally gregarious, but that possibility seems a poor comfort to the magnate whose fortune has to depend on it. Rather, he turns to a report by the Academy of Motion Picture Arts & Sciences which differs with Mr. Prall absolutely. It states that all is well and that the motion picture industry has nothing yet to worry about from television.

Restrictive Clauses in Sound Film Recording Contracts

"There appears no danger that television will burst unexpected on an unprepared motion picture industry," says the Academy, and since this is comfort from his own, the magnate dreams comfortably of *apfelstrudel* and dividends. Whether this is simply whistling in the dark, or is a private word of assurance based on evidence undisclosed to the public, is anybody's guess; but at the risk of destroying peace of mind in Hollywood, we offer as a clue the following clause for a contract that conditions production by ninety per cent of the sound motion picture industry:

> No licenses are herein granted or agreed to be granted for any of the following uses or purposes:
>
> (1) For any uses in or in connection with a telephone, telegraph or radio system or in connection with any apparatus operating by radio frequency[2] or carrier currents. . .

Television can operate only on radio frequencies, or on carrier currents through wire cables. This clause is a part of the contracts between the American Telephone and Telegraph Company and seven of the eight major pro-

[2] In the first sound recording contracts between the Bell telephone system and the Vitaphone Corporation, television was specifically mentioned, but in characteristic fashion this was withdrawn as events and legal stipulations came near toward conflict.

ducers of pictures in Hollywood[3]. Have the movie men been assured by their masters that television will be allowed to develop only as the masters will? Or have they overlooked that clause entirely and simply concluded that movies have their place in the world and can't be shaken out of it?

[3] This situation has since been modified in several respects, but as far as con be ascertained, film recording contracts have not been liberalized to permit television reproduction. One exception is Pathe, which was granted an inclusive license by RCA—but this is in the nature of a family affair.—Ed.

We cannot but succumb to our habit of quoting official documents as a means of showing that there is more than guesswork and intuition behind the warning that the movies may be on their way to extinction or absorption. Bear with us in a flashback of history concerning the sad story of the silent film and the sound machine. It is told briefly in two excerpts from the memoranda of a memorable character whom we shall identify shortly. He, more than any other, drove the nails in the coffin for Gene Fowler's fabulous "Father Goose". Here is memorandum number one:

> The motion picture industry in the United States owes us about sixteen million dollars and our expected revenues from the industry for the next ten years is about sixty-five million dollars. This is a large stake and establishes our interest in the welfare of the motion picture industry.
>
> The industry is in a serious financial condition and some of the larger companies are faced with possible receiverships. The morale of the management in many instances has been greatly lowered. Unwise remedies are being applied and reorganization efforts are being made that in all probability will not be successful. As a result of these conditions our stake is in jeopardy.
>
> We are the second largest financial interest in the motion picture industry. Our stake is next to that of the Chase Bank. . .
>
> I believe that the protection of our interests in the motion picture industry requires that we should have authoritative conferences with the Chase Bank at the present time. Our interest should be made clear and our influence felt. We can do things the Chase cannot do in the interest of the common good and Chase can do things we cannot do. . .

Number One was written on November 5, 1932.

Number Two:

> I have also had innumerable proposals that ERPI go into this or that phase of the motion picture business. These I have declined without bringing to your attention because I recognize such proposals to be oontrary to the Bell system policies and interests, and even though they offered ERPI opportunities for advantage and benefit. It is true today, as it has been for three or four years, that the Telephone Company can control the motion picture industry through ERPI without investing any more money than it now has invested.
>
> I am not recommending that this be done, even though I know that the salvation of the picture industry lies in this direction. The industry is in crying need of the kind of strength and character that could be obtained through the influence of the Telephone Company.

Number Two was written December 7, 1933.

Had "this direction," as described in the correspondence between J. E. Otterson and E. S. Bloom, officials of the American Telephone and Telegraph Company, been followed, all of the motion

picture industry would soon have found itself under a single management, with a single studio-operating organization and turning out pictures to be sold and exhibited through apparently competing sales systems. And, according to most standards of artistry and theatrical enterprise, disastrous effects upon the movies as entertainment would have been invited thereby.

License Revision Needed

It is crystal clear that only the judgment of its distant financial masters left the motion picture industry a figment of independence when it tottered under the impact of sound technique. That figment of independence has been nourished carefully since, but never enough to allow the movie moguls to re-establish themselves completely.

Let us remember and never forget that of the eight major producing companies, seven are bound up so that *they cannot sell or lease their films for television if they want to;* and that is why, perhaps, the Academy of Motion Picture Arts and Sciences recommends no fears. They put their faith in the cool judgment of the financiers far away to ward off the new threat . . . But what of that great industrial magic, Competition?

The telephone system moved in on the motion picture industry with a new technology, the sound films, and tied up ninety per cent of production with its contracts. Of the remaining ten per cent, the apparent competitive fringe, virtually all fell into the hands of the Radio Corporation of America, which proposes itself to be the perennial nemesis of the wired communication services.

And not too unsuccessfully, as witness this further memorandum by an A. T. & T. Company official:

> In the talking motion picture field they (RCA) are competing very actively with us at present, as you know, to develop an affiliation with the larger motion picture producers, and competition between us will doubtless ultimately result in a situation highly favorable to the motion picture interests and opposed to our own.
>
> This is an extensive and highly profitable field and it is quite worth our while to go a long way toward making it practically an exclusive field. I believe that we could justify from a commercial standpoint paying a large price for the liquidation of the Radio Corporation for this purpose alone.

The author of this remarkable view was by no means foolish. Events show that he saw correctly the problems of protecting vested interests in time of technological change. And perhaps it is because the motion picture producers realize that they are really in no position of command just now that they cower like white rabbits as events start their march again.

Extend Essannay Contest

The close of competition in Larry Strong's earliest changeover search has been advanced to August 1st. The contest seeks to locate the longest operating Strong changeover, for a letter on which and possession of the changeover, Mr. Strong is giving a $100 Victory Bond plus a set of new 1946 Strong Zippers. Winners of the competition will be announced Sept. 1st instead of July 4th as originally planned.

CORRECT P. A. TECHNIQUE

(Continued from page 6)

hundred watts is considered the minimum required.

Now, then, so doing will require horns that will handle this respectable amount of power. In general, eight units will be required: 4 low- and 4 high-frequency units. Since horns to accommodate these units are quite bulky, we are right back from whence we started. This endless vicious circle is best broken by either moving the microphone back or the horns out into the auditorium. The use of cardioid or other directional microphones will prove helpful and is earnestly recommended. Limiting amplifiers should prove useful in this connection, provided they are capable of properly driving the power amplifiers.

'Talent' Demands Unreasonable

This is a proper place to make a plea for better education of "talent" in the use of microphones. Severe abuses by artists who should know better are frequently noted. They do not seem to realize that in many large theatres they cannot judge the volume in the auditorium from their position and (unless they hear some reflected sound or if their gags flop) they shout for more volume.

Some of them bang the microphone or manhandle the stand, even call for more volume during their act, when all the time the auditorium volume is more than adequate. The P.A. control operator, who usually is located in a most unfavorable location to properly judge volume, in turn keeps increasing volume as per demand. Ultimately it becomes an undisputed fact that all theatres run their P.A. systems much too loud.

Why the audience does not condemn this practice by complaining about it, or why the management tolerates it, will never be understood. However, the fact remains that the P.A. is too loud. Let's tell our customers, the exhibitors, about it. Maybe he will listen and do something about it.

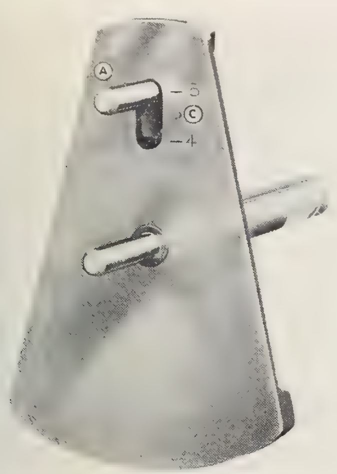
LITTLE AND KREUZER IN NEW POSTS AT RCA

Appointments of J. R. Little as manager of the RCA Theatre Equipment Section and Barton Kreuzer as manager of RCA film recording activities have been announced. Little was for the last 18 years engaged in merchandising and sales promotion activities for Montgomery Ward and Co. He has spent the last five months visiting theatre dealers throughout the U. S., making a survey of their requirements. Distribution of RCA theatre equipment through independent RCA dealers will be continued.

Kreuzer joined RCA in 1928 and has served successively in the company's development, engineering, installation and service, and commercial departments. He directed RCA's New York film recording studios in 1935, and two years later was transferred to Hollywood to head RCA sound recording activities there. During the war, Kreuzer supervised the production and distribution of RCA theatre and film recording equipment for the use of the Government.

New Universal Rewind 'Mule' Offered by Essannay

Among the many gremlins that beset a projectionist in a modern projection room, one of the most annoying is to have the key



Simple pressure of the thumb applied to the pin (a) adjusts the Strong Universal Rewind "Mule" for 4 or 5 inch, or Exchange reels, as indicated on the plate. Dot (c) is the position for Exchange reel rewinding. "Mule" comes with a ground one-piece shaft, and it can be furnished for any type of enclosed rewind.

of the rewind take-up shaft break. This necessitates the dismantling of the rewind to install another key. To overcome this difficulty many projectionists have had a collar made that fits over the rewind shaft, this collar having a pin that fits into the finger-holes of the reel. These makeshifts, however, can only be used with one size of reel—either a 4″ or 5″—and when made for one reel size, cannot be used with another. Larry Strong of Essannay Electric Mfg. Co., Chicago, has designed a new universal drive "Mule" that can be installed on any enclosed rewind. The Strong "Mule" has an adjustable pin that, by merely the flick of the thumb, adapts it for us with any make 4″ or 5″ reel, including exchange reels. Details from Essannay at 1438 No. Clark St., Chicago, 10.

TELEFILM SUES WARNER AND MacKENZIE ON RACE FILMS

Harry M. Warner, film executive, and Jack MacKenzie, Turf Club manager, are accused of conspiring to pirate the business of taking 16-mm motion pictures of horse races from Telefilm Studios of Hollywood in a suit on file in Superior Court in Los Angeles. Demanding $1,000,000 damages, the Telefilm company, originator of Telefilm Control whereby processes were introduced for lightning development of horse race films for showings to judges immediately after the running of races, complains that Warner and MacKenzie secretly engaged services of Telefilm crews to obtain information about the film process.

SPLICING 16-MM FILM

Every old-time 35-mm projectionist thinks he can make a 16-mm splice pronto. I can make ten first-class splices on 35-mm nitrate stock in the time it takes me to make one good splice with 16-mm *acetate* stock. After making a thousand or more 16-mm splices, my advice is this: scrape off the emulsion dry; scrape the "shiny" side of the other end to remove process coating; use any good cement; leave the splice in the splicer several minutes; gauge the depth of scraping and the splicer "time" to give a non-curling splice. Let the splice dry for at least 15 minutes.

16-mm acetate film is extremely susceptible to humidity and temperature effects, much more so than 35-mm nitrate film. Do not let test loops become older than about two weeks: you cannot tell whether it is film or the gate with in-or-out of focus effects in the adjustment of the projector.

Pull-Down on One Side

Always bear in mind that you are "pulling down" on *one* side of 16-mm while you are getting the same action on *both* sides in the case of 35-mm. Therefore, the problem of picture jump is greater in 16-mm. Watch back plate and tension shoe alignments and pressures closely in 16-mm.

Sound. The general idea of dropping one set of sprocket holes was a dumb piece of business when 16-mm went to sound. There should have been a transition to 18-mm, or whatever was required to provide the left-hand sprocket holes. So much for that. Notice that the conventional pressure shoe scrapes and wears the sound track at its edges. This is unavoidable. In checking sound, you may find that the higher level passages may be distorted or "clipped." Take a good look at the sound track.

[Ed.'s Note: The foregoing leads us to ask out loud why we can't have test loop stock on nitrate film? They are more satisfactory and last ever so much longer. Sure, ship them in small lots and store them likewise. We would also like to see test reels on regular nitrate stock.]

RCA's New In-Car Speaker a Rugged, Compact Unit

A weatherproof and "foolproof" in-car speaker, terminal box, and speaker-receptacle unit for drive-in theatres, designed for permanent location on the parking ramps, is offered by RCA. Rugged, compact, and designed to withstand all kinds of weather, the new speakers are mounted in brackets, one at either end of a terminal box to be installed between two ramps, within easy reach of patrons from their car windows. This eliminates excessive handling and delays involved under the old system used by some drive-in theatres, where a speaker was passed out to each car as it drove in, plugged into a terminal at the ramp by an attendant, and turned in at the exit as the patron left.

The new speaker has a new type of coiled speaker cord which enables the patron to place the speaker anywhere within the car without the tangling and dragging of a long straight cord.

The individual in-car speaker eliminates many problems inherent in centralized speaker systems. It permits use of the speaker with the car windows closed in cold weather, thus extending the length of the regular operating season. The RCA in-car speaker also has an adjustable volume control, enabling patrons to adjust the sound level to their own satisfaction. The speaker itself is of special design for acoustically correct operation inside a car. An attached bracket makes it easy for the patron to attach the speaker to the car window or any convenient support inside the car.

Guessing

can be expensive

Guessing can be expensive at any time but particularly so today with the present limitations on new projection room equipment and with the uncertainties of replacements. Every projectionist should know the whys and wherefores of his equipment. He should know what to do and what not to do when the equipment fails to function properly—and how to keep the show going until the service inspector arrives at the theatre.

PROJECTIONISTS' SERVICE MANUAL is a complete, compact compilation and a valuable reference work. All items therein are grouped according to classifications and contain sound practical suggestions relating to the many projection room troubles—their causes and how to remedy them.

A copy of this valuable trouble shooter should be in every projection room for instant reference and as a trouble guide. Many I. A. local unions have ordered this book in bulk and placed a copy in each projection room. The price is right —only $3 per copy, postage prepaid. Order your copy now or ask your local union secretary about our special low-price bulk offer.

Send for it Now! *Do Not Delay*

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19 West 44 Street, New York 18, N. Y.

Gentlemen: Enclosed find $3.00 for which please send to me a copy of PROJECTIONISTS' SERVICE MANUAL, postage prepaid.

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CHICAGO JULY 1946

INTERNATIONAL PROJECTIONIST

JULY 1946

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ON BEHALF of the hundreds of I. A. members in the Chicago area, we of the Arrangements Committee for the 38th I. A. Biennial Convention welcome you to our town. We are deeply conscious of the high honor accruing to us in receiving as our guests the representatives of the thousands of distinguished craftsmen throughout the United States and Canada who comprise our great Alliance.

To you of the living stage, the founders and protectors of our Alliance down through the years, who through superb stagecraft provide within the area of three bare walls a fitting background for drama and laughter, music and color;

you from the production studios whose myriad collective efforts, by some strange alchemy succeed in imprisoning on film the cumulative contributions of many minds, many hearts and many hands;

you who rove through city and town, highway and byway, in the air, on and below the sea, and in the bowels of the earth in every sector of the globe to capture by the magic of your camera those contemporary events which are history in the making;

you whose unceasing vigilance in film-distribution centers insure the safe transit of a precious cargo;

you in thousands of projection rooms who daily bring to fruition the sum total of industry effort by utilizing expertly a narrow ribbon of film to effect delivery of the finished product to the public;

you technicians whose inclusive knowledge and precise calculations effect the proper installation and uninterrupted smooth operation of delicately-wrought and finely-machined equipments; and,

you most recent additions to our Alliance family whose efforts are directed toward flinging into the ether a complex pattern of sound and picture which will provide additional entertainment for uncounted millions—

to all you practitioners of a living, vibrant art that serves to lend a deeper meaning and added breadth to life, we bid you welcome—thrice welcome.

We have striven to the best of our ability to make easier the important work confronting you at this Convention, no less than to provide every facility for relaxation and diversion from your arduous tasks. May success attend your business deliberations; and during the lighter moments of your stay in Chicago we hope that you get to know us and to like us.

We wish you, also, Godspeed on your homeward journey, and we hope that accompanying you will be the memory of a most profitable and pleasant visit in our town.

EUGENE J. ATKINSON.
Chairman

Welcome

to

I. A. DELEGATES

from all the

CHICAGO I. A. LOCALS

Craft	*Local*
STAGE EMPLOYES	2
PROJECTIONISTS	110
STUDIO MECHANICS	476
CAMERAMEN	666
TREASURERS	750
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Greetings...

from the President of the A. F. of L.

Many changes have come to the entire world since the formation of your International Union more than fifty years ago, but none has been more marked than the realization of the general public that entertainment forms a very important part of our lives and in many instances conditions ability to work and carry on under strain. In the early days of your organization most people thought of entertainment as a pastime only. Now eminent doctors, psychologists and psychiatrists are prescribing entertainment for both bodily and mental ills as an outlet for emotion and to divert thought from personal to impersonal matters.

In the educational world more and more reliance is being put on visual education, and the use of films is playing a very important role. Certain theatrical productions are a required part of educational courses in some of the most valuable subjects in our educational institutions. It is thus obvious that your members are making a very real contribution to both the mental and general physical welfare of our nation.

The economic problems of today which every wage-earner must face are complex and of potential importance to all. The cost of living is a very real problem to the man whose take-home pay has been lowered while costs of food, clothing, medical care and the like are skyrocketing. It is obvious that the crying need of today is a balanced and stable economy—employment for all who want to work at wages which will provide a ready market for the output of industry producing at peak capacity.

The International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators is one of the most representative in our country. Those responsible for the growth of your organization have done a splendid organizing job and made your Union one of the strongest in the country. Your Union has served its members well in the past, and I am confident will be of even greater service in the future.

WILLIAM GREEN

International Alliance of Theatrical Stage Employes and Moving Picture Machine Operators of the United States and Canada

Affiliated with the
American Federation of Labor

RICHARD F. WALSH
International
President

WILLIAM P. RAOUL
General
Secretary-Treasurer

THOMAS J. SHEA
Assistant International President

Suite 803, International Building
630 Fifth Avenue
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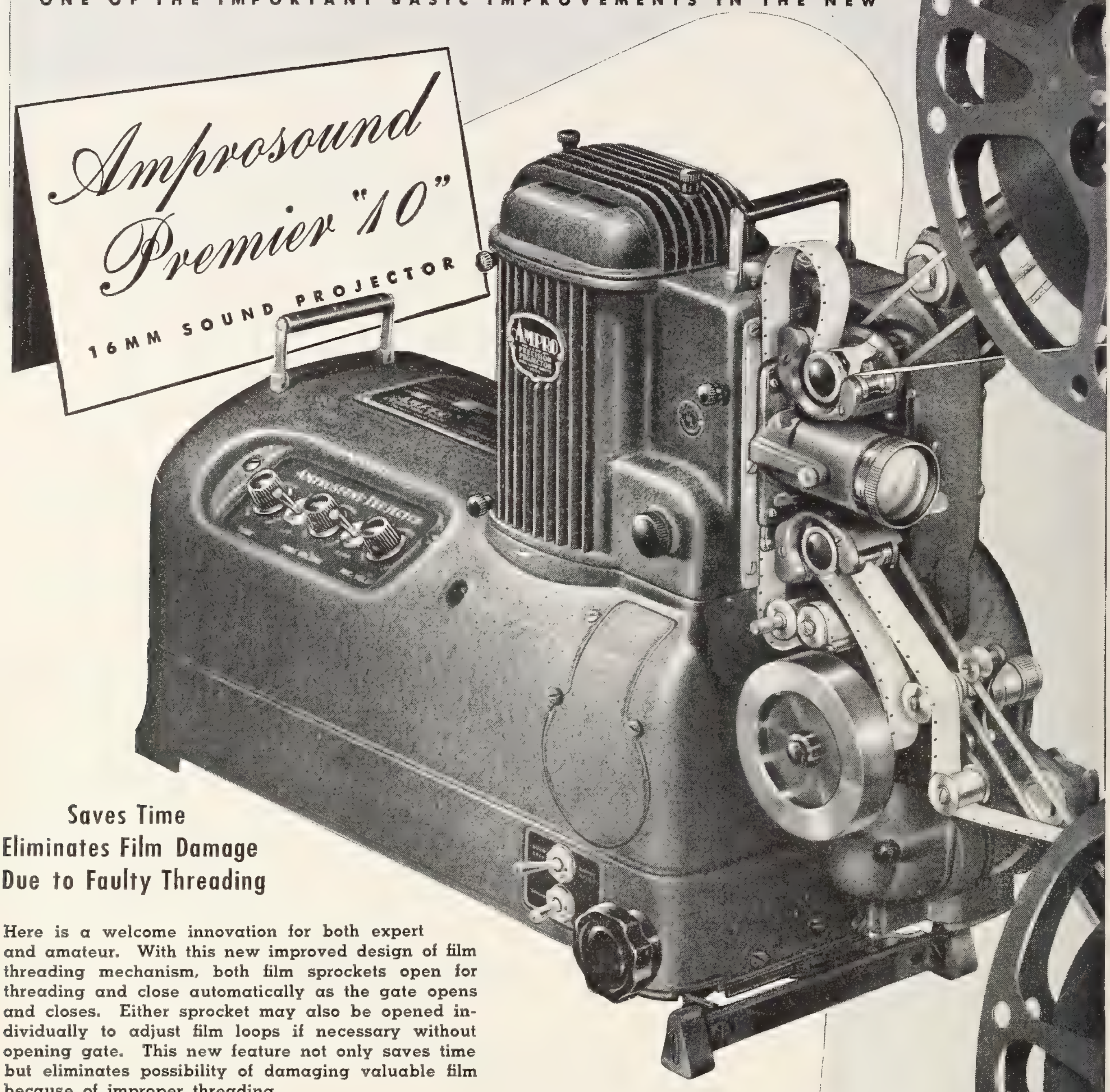
New Quick Easy Threading System

ONE OF THE IMPORTANT BASIC IMPROVEMENTS IN THE NEW



Saves Time
Eliminates Film Damage
Due to Faulty Threading

Here is a welcome innovation for both expert and amateur. With this new improved design of film threading mechanism, both film sprockets open for threading and close automatically as the gate opens and closes. Either sprocket may also be opened individually to adjust film loops if necessary without opening gate. This new feature not only saves time but eliminates possibility of damaging valuable film because of improper threading.

This is but one of the many basic advantages offered by Ampro 16 mm. sound projectors which are rugged, sturdy, and designed to give continuous efficient performance. Special Ampro features include: Centralized Controls, Triple Claw Movement, Centralized Oiling System, Quick Set-up, Quiet Operation. Write today for folder giving specifications, prices and full details.

Ampro 8 mm. Silent Projector

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ARMY E NAVY

The Army-Navy "E" has been awarded to Ampro for excellence in the production of 16 mm. motion picture projectors.

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'Stand by!' Alerts the Television Studio Crew

By IRINE PETROFF

Television Broadcasting Studio
Employes, I.A. Local 794, New York

STAND BY! The studio manager raises his hand and silence pervades the studio. Each member of the crew is in pisition, tensely awaiting the words, "Take it away, Studio A"—and the show is on. The ensuing show is what the television-viewer sees as he relaxes in his home. But no matter how simple the show may seem to the audience, there are innumerable complex operations required of all personnel before, during and after the presentation.

Before the show is "aired" a script has been prepared, a scene designer has created sets to establish a mood, the set painters have executed the designs to the minutest detail, sets are assembled in the studio, props are chosen, and the proper opening, closing and incidental music has been selected and cued. By the time the show reaches the studio, dialogue has been *memorized* by the actors (no reading from scripts) and the action has been blocked out. Then follow hours of rehearsal with cameras and sound. The show is finally ready for "airing."

The director, watching five monitoring cathode-ray tubes (four pictures, each showing the output of one camera, and one camera which shows what is being sent out over the air)—the director gives directions to the production assistant. The latter sits at a control panel making the necessary switches from one camera to another into the outgoing channel by means of a series of interlocked push-buttons. It is he also who relays all directives from the director—adding a few of his own—to the studio crew.

The Director's Comprehensive Control

Through the monitoring device the director has a previewing instrument so that he may call for changes in composition, focus and angle before the output of the camera is switched on the air. It also gives the video engineers in the control room time to make any shading adjustments necessary and to delete any discrepancies in the picture. The audio engineer in the control room takes direction from the director on music and "riding gain" for sound from the studio.

Naturally, the most important person on the floor is the studio manager, for to him falls the responsibility of seeing to it that the show runs smoothly. In addition to cueing all action on the sets, he has to make sure that cameras, mike boom and lights all move in perfect coordination. He must always be prepared to meet any emergencies that may arise, such as unrehearsed shots and finding suitable places for the announcer.

To the cameraman falls one of the most important and trying jobs, for he realizes that *there can be no retakes in television;* the first chance is also the last. Getting a good, clear image is the sole responsibility of the cameraman, because anybody further along the operational line can only transmit exactly that which the cameraman puts out.

The studio assistants are the bane of an actor's existence, for they operate the lights which are necessarily quite merciless. Knowing that a good image requires good lighting, the studiomen assure maximum illumination by placing the vertical banks of lights as far upstage as possible. While some studiomen work with the lights, others are literally up to their ears trying to keep the cables of all cameras straight and preventing them from breaking apart.

Leaving the studio control room, the output is sent up to master control. Two engineers work in master control: one shading the pictures which are originating from either the studios or from film, the other switching from various studios or dissolving any film with any studio. The signals are then sent via coxial cable to the transmitter where the pictures are once again monitored by the transmitter engineer. A master control audio operator is busy mixing all sound originating from studios, films, or turntables, blending all together for the desired effect.

The sound is then sent along telephone circuits to the transmitter from which it is sent out to accompany the video image being transmitted. Over radio frequency waves the video information travels to our viewer still enjoying the show as it draws to a close.

Back in the studio, the cameras are on final shots or title cards for the ending of the show. But regardless of the fact that this particular show is ended for the audience, such is not the case for the studio crew. The studio manager is signalling the announcer in front of one camera, another camera is set up on a clock, and studio assistants are switching lights to the new sets. As the announcer bids the audience good-night, the studio manager lowers his hand ("Studio off") and the first audible breath is taken by the crew. ★ ★ ★

Philosophic Background of Unions

By SUMNER H. SCHLICHTER, Ph.D.

TO THE man in the street, the principal function of unions is to raise wages and reduce the working day. But this conception misses the main significance of labor organizations. Primarily they are significant because of their relationship to the government of industry. In the early Middle Ages, sovereignty and property were separated—the ownership of land carried with it many powers that have since become functions of the state. The gigantic units of modern industry appear to be bringing about a reversion to the days when the sovereignty was an attribute of property.

With the ownership of property went the power to prescribe rules which affected employees as intimately as did the ordinances of the city in which they lived, rules which prescribed when work should begin, how long the men should

(*Continued on Page* 97)

Modern Stage Lighting

By EUGENE BRAUN
Lighting Director, Radio City Music Hall
Member, I. A. Local 1, N. Y. City

Thyratron light console having 314 individual controls providing for presetting as well as advance-switching of circuits for any number of scenes; also for fading thru from one scene to another, and for proportional dimming.

STAGE lighting has come of age. From the old sixteen-candlepower carbon filament lamps in the white-painted open trough of the footlights to the 150-watt Mazda lamps in well-designed, individual reflectors; from the 32-candlepower carbon lamp in the open trough border light to the 500-to-1000 watt lamps in efficient, reflector-equipped individual compartments; and from the 250-watt carbon filament baby spotlight to the 5000-watt Fresnel light in a few short years—these advances mark a great development in today's stage lighting equipment.

Science and industry developed the Mazda lamp, and the theatre has adopted it to its own very good use. Now commerce and industry are borrowing our methods. Numerous business establishments have equipped their show windows with our type of spotlights, showing off their displays to good advantage. Many commercial and industrial installations have in recent years made use of the downlight, which also had its origin in the theatre. That others are adopting the lighting methods of the theatre is added proof of the progress we have made and of our contributions to the lighting art.

Stage lighting, as a general rule, exemplifies the correct principles of illumination. Light sources are usually concealed from view and no glaring light sources are permitted to mar the spectator's appreciation of the stage picture. In approaching the problem of stage lighting, we have to keep in mind the various functions lighting serves on the stage: furnish general illumination sufficient to make visible the action on the stage, and to furnish interpretation, wherein lighting is second only to the acting.

Light as a Mobile, Facile Medium

Scenery set on the stage usually remains during a scene until "struck," whereas light is at all times a mobile medium. Light can be made to grow dim or bright and change from one color to another. It can also move about the stage as well as the actor. It may suggest the time of day or the seasons of the year. Sunrise, sunset or moonlight can be indicated by light. It can establish the mood of the play or scene, either gay or dramatic, tragic or majestic. It can project clouds, rain, fire and flame, rippling or running water, stars, the moon and countless other effects.

In almost every show color in the lighting is necessary, since by this means we can enhance the coloring in the costumes and scenery. We can by proper manipulation of color change a forest scene to a desert, an autumn scene into a snow scene. With the knowledge of the effect of colored light on colored objects, many startling color combinations are possible. To be able to use this vibrant, living medium, light, for the various purposes enumerated many different types of lighting instruments are indicated. Familiarity with the possibilities and the limitations of each piece of equipment will be of great help to the lighting technician in selecting the proper unit for a specific lighting result.

Lighting practice in the theatre is governed mostly by the needs of each individual production. Permanent installations of a comprehensive scope are rare in the legitimate theatre, so it is necessary for shows playing in these theatres to carry their own lighting equipment. Among the few exceptions, adequate installations are to be found only in the motion picture and presentation-type of theatres of which the installation at the Radio City Music Hall, New York City, is the latest and perhaps the best example.

Frequent changes of productions, coupled with the limited time available for these changes and for rehearsals, were the guiding factors in planning and equipping the Music Hall stage with a lighting machine sufficiently flexible to serve the needs of any of our productions.

Anent Footlights and Border Lights

Many of the legitimate shows have dispensed with the use of footlights entirely, perhaps because they were so inefficient in light distribution and direction. This, however, is no valid reason for leaving the footlights out of the permanent installation, provided they are of modern type. Actually we find the footlights very useful in our own work, for many reasons: to minimize face shadows of the performers, add color to the scene when needed, and frequently to smooth the top of "drops." Used judiciously, the footlights are a distinct asset in an installation.

The footlights at the Music Hall consist of 100-watt lamps in white, amber, red and green circuits, and 150-watt lamps in a blue circuit. The lamps are spaced $4\frac{1}{2}''$ on centers and are enclosed in matte-finished individual aluminum reflectors equipped with natural colored glass

roundels. These footlights are so constructed that, when desired, they can be made to disappear into the stage floor.

The old-fashioned border lights, like certain footlights, have also fallen into disrepute because of inefficiency. In many instances they have been supplanted by spotlights and individual open-box hoods. In the Music Hall installation we have had special reflectors designed for our border lights and have supplemented the general lighting thus obtained with groups of spot-floods and individually-controlled spots. In this way we have many valuable resources to draw upon, such as general lighting with a downward component predominating; spot-floods, when needed, with or without general lighting, and highlighting with the individual spots, when required.

These borders are actually border bridges, accessible from the fly floor, or, when lowered, can be reached from the stage floor. Lighting equipment consists of 500-watt lamps on 12-inch centers, divided into four color groups, with twice as many blue filters as any of the other colors. This is to compensate for the increased absorption inherent in this color. Gelatine color screens are not very stable, become brittle and require frequent changing. The Music Hall borders, therefore, are equipped with natural colored glass screens, carefully selected for purity of color and heat resistence. In practice they have served their purpose very efficiently.

120 2000-watt Spot-Floods

The spot-floods are equipped with 2000-watt lamps and are connected to a shaft to permit tilting the whole group either straight down or in any position to horizontal. Each unit is equipped with four color screens and each screen is connected to a Selsyn motor. The Selsyn generator for each color group is operated by an induction motor the speed of which can be selected by switching at the main control board to produce any one of five speeds, thereby enabling operation of the color screens from this remote position. Altogether we have 120 of these 2000-watt spot-floods equipped in this manner and divided into 80 control groups. Each border bridge is also equipped with 2 arc-spot outlets for special effects whenever needed.

The cyclorama border light is equipped with 500-watt lamps in amber, red and green circuits; 750-watt lamps in a daylight circuit, and 1000-watt lamps in a blue circuit. The cyclorama "foots" consist of 200-watt lamps in each color with twice as many blues as any other color. Normally these units are located in a recess provided in the stage floor, but were made in portable sections.

The light bridges, located at the 30-foot elevation on each side of the stage are a very vital part of our lighting plan, where each entrance is equipped with three 2000-watt spots, one 2000-watt flood, and one 150-ampere arc-spot. To round out the human form, to add third-dimensional qualities to the stage set, and to create interesting shadows, these side lights are constantly in use. We supplement the side lighting with semi-portable towers, similarly equipped.

To illuminate the stage apron, the proscenium spotlights were provided with a special pocket directly ahead

(*Continued on page* 93)

What the 1946 I.A. Convention Means

By DR. ALFRED N. GOLDSMITH

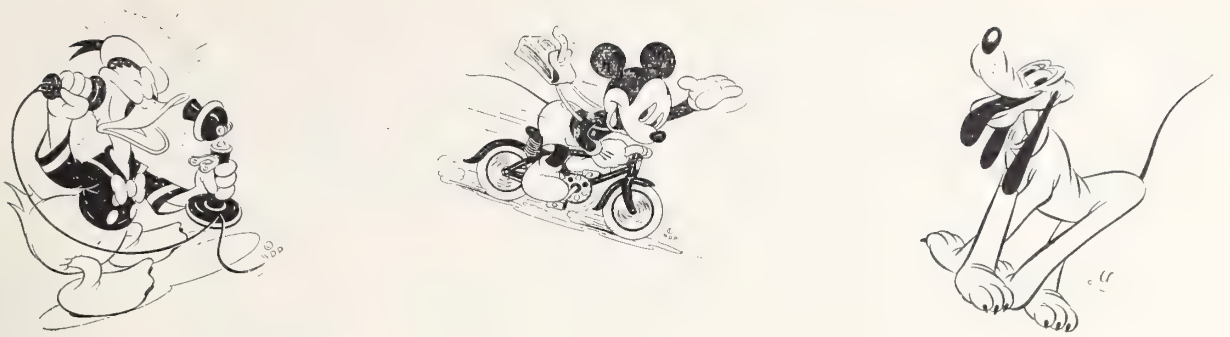
Honorary Member, I.A. Local 306, N. Y. City

FIFTY-THREE years ago a farsighted group of theatrical workers founded what has now become the great International Alliance of Stage Employees and Moving Picture Machine Operators of the United States and Canada. In the intervening half century this organization has grown from humble beginnings to a group comprising the most widely diverse workers in the field of picture-and-sound-purveying to the public. Those who handle film, who photograph dramas, comedies, or news on such film; those who direct photography; those who handle the operations of studios; those who record sound; those who oversee the development of film; the group which edits the film prints; those who handle the film in exchanges; those who project it at the studio or in the theatre; those who service equipment in the theatres, and those who handle equipment on the stage; and those who install such equipment—all these are comprised within the wide scope of the I. A. T. S. E. In addition, the Alliance extends into the field of projection of sub-standard size non-theatrical film and into the realm of television.

Almost from the day that a great picture and its accompanying sound are conceived to the moment that the pleased audience enjoys the performance in the theatre, school, or home, the I.A. worker plays a fine part.

Great technical skill and wide experience is required to carry out each of the various jobs which I.A. men have undertaken. And as the new fields of video and audio entertainment develop, it is to be expected that I.A. members will increasingly fit themselves by study and experimentation to carry out their part in the development of such fields. Among these new fields, which are of great interest, is that of television broadcasting—an industry destined to be a great agency of public instruction and entertainment.

I.A. members have at once a great opportunity and a major responsibility. It is their responsibility to learn all about their field of endeavor, to keep up to date, and to foresee the future and be prepared for it. It is their opportunity to be indispensible workers and leaders in the existing and new fields. And it is their opportunity to make the public feel, concerning the I.A. membership, that never have so many people owed so much entertainment and so many interesting hours to so few skilled workers. ★ ★ ★



Home From the Wars: Donald, Mickey and Pluto

Top animator 'mugs' in mirror as aid to good characterization.

Production Steps in a Walt Disney Cartoon

By WILLIAM HOSIE
Walt Disney Productions

WALT DISNEY'S Mickey Mouse, Donald Duck, and all their pals went completely "all out" in the service of their country during the war—but now they are back. When the world upheaval fully calms down, Walt may want to go to Europe or Australia and do pictures based on the music and local color, as was done with his South American pictures. This will be his contribution to the good-will of the world at peace, and should be a potent force in helping peoples of different countries to understand each other. Key men are daily returning to the studio from the various war zones. Promising talents are being trained in special studio classes. The physical plant is also being enlarged to accommodate an extended and intensified activity in every department.

The Disney policy, under the constant and watchful eye of Walt himself, has been defined as a continuous advance toward perfection with every foot of film turned out. This is a never-changing process of searching and testing new ideas, of refining technical methods, inventing and improving fresh effects and, to sum up, continue to provide the public with motion pictures that shall combine beauty, humor and romance, the priceless ingredients of all good entertainment.

With Walt Disney's entry into the full-length production field, his methods of creating animated pictures have become increasingly complex. Gone are the days when most of a picture was worked out by Walt and a handful of co-workers sitting around a luncheon table. Now, the script for a Disney feature more closely resembles the script for a regular motion picture.

The short productions, however, do not require such scripts. Instead, the brief plot is laid out in a series of colored pencil action sketches pinned in sequence on a huge board. When the story is worked out satisfactorily, the board is moved from the rooms of the story crew to those of the director assigned to the picture. After any changes that he may make are approved by either Walt or his production supervisor, the director calls in the musical director, layout man, background artists and animators who have been assigned to the picture. They hold as many meetings as are necessary until each man knows what the production requires of him.

The animator, however, does not begin to draw a sequence of action until the background layouts are finished, and the dialogue, sound effects, and music have been recorded. The animator must watch the scene layouts carefully so that he will not have his characters walking through such objects as furniture, buildings or trees.

Thousands of Drawings Per 'Short'

After the dialogue track is recorded, it is turned over to the cutting department where it is analyzed and a chart prepared which shows, in terms of single frames of film, the length of each word, the intervals between words, the vowel and consonant sounds, accents, inhalations and exhalations. The animator draws from this pattern. If the character says "hello," for instance, and the cutting department has indicated that this word, recorded, occupies eight frames of film, the animator must produce eight drawings in sequence in which the lips of the character move to form the word, plus whatever bodily accent may have been decided upon by the animator, director, and oftentimes Walt himself. General sound effects are charted in much the same way.

The average person, upon learning how sequence of action is obtained, almost invariably poses the question: "Well, then, how many drawings are required for a typical Disney cartoon release in color?" An accurate answer to this query demands first a definition of the term "draw-

ings." The number of preliminary sketches and semi-finished drawings incident to a single release is truly astronomical; but an idea may be gained from the fact that a "typical" Disney color cartoon—about 700 feet in release print form—requires approximately *45,000 finished color drawings!*

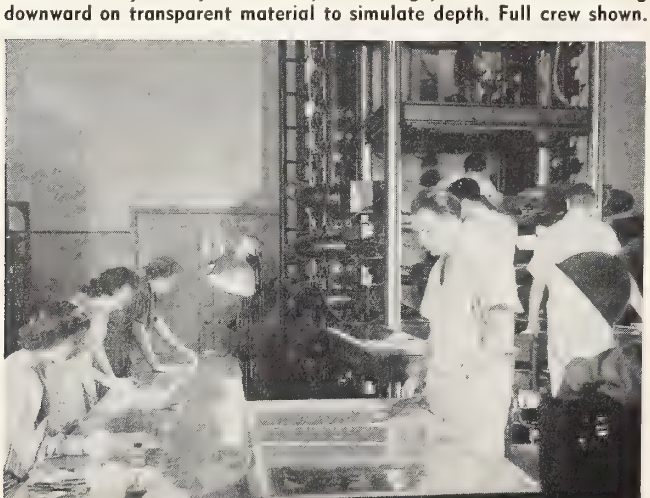
The animators have assistants who work under them in developing action. While an animator draws the most difficult and important points of action, his assistant follows through along the course indicated by the animator. These drawings then pass to the "in-betweeners," so-called, who are less experienced artists. They do the small, finey graded changes completing the action. The animators work on an illuminated drawing board. This is done so that after one drawing has been completed, a second piece of paper can be placed on top of it and the new drawing varied just enough to make the movement smooth and natural-looking.

A completed series of drawings is photographed and returned to the animator who runs the film on his own little projection machine. He studies it to see that the action is smooth and that the over-all effect is as it should be. This rough test must then be approved by the director and the production supervisor. In addition, Walt himself keeps in close enough touch with the making of every picture so that each step has his approval.

When the drawings are approved they are sent to the inking and painting department. This department is composed solely of girls who transfer the drawings to sheets of transparent celluloid and outline the characters with pen and ink in such a skillful manner that they lose none of the charm of the original drawings. Other girls apply the chosen colors of paint to the reverse side of the celluloids so that the inked outlines will show. Paints used for the Disney productions are ground and mixed within the studio paint laboratory from especially worked out formulas, and the colors and shades of the paints and inks total over 2,000!

After the celluloids are finished they are sent to the camera department. Each celluoid is placed over the correct background and photographed. After a production is filmed, the processes leading up to the finished product are very like those in a regular motion picture studio. The sequences are put together and previewed for audience reaction. The picture is then either released as it stands, or organization had paid out more than $3000 in benefits.

Famous Disney Multiplane Crane, 15 ft. high, with camera shooting downward on transparent material to simulate depth. Full crew shown.



it undergoes some further editing at the studio, all depending upon how it has been received at the preview.

The steps in the production of a full-length animated picture follow the elemental short subject pattern, a short subject being basically comparable to one sequence of a full-length production. Therefore, a feature may have as many as six directors, with each directorial unit responsible for the making of several sequences of the picture.

★ ★ ★

TMA—Daddy of Them All

By FRANK GALLUZZO
Grand Secretary-Treasurer, TMA

ON NOVEMBER 25, 1883, a small group of men assembled at 32 East 1st St. in New York City and organized fraternal association based on understanding and the promotion of good fellowship among the mechanical workers in the amusement field. Thus was the beginning of the Grand Lodge of the Theatrical Mechanical Association. Three lodges were represented at this meeting, represented by the following men: From New York: John A. Thompson, Joseph H. Thompson and John Nunro; fror Philadelphia: John Penrose, James Meyers and John L. Furze; from Boston: Hilliam J. Moorehead, Frederick Weld and Charles E. Taylor. The first president of the Association was John A. Thompson, of New York.

A Chicago Lodge was instituted in 1884, with Ralph M. Betchel as the delegate. Amusement mechanical workers all over America were intensely interested in TMA by the time the first biennial convention was held at Buffalo in 1887. Here it was that Thomas J. Bent of Chicago was named Grand President. By 1891 TMA had grown to 130 lodges throughout the United States and Canada and had more than 5000 members. Up to this point the organization had paid out more than $3000 in benefits.

Succeeding conventions saw TMA grow by leaps and bounds. It was at the Toledo convention in 1919 that the organization changed its name to Theatrical Mutual Associations, its present title, and at the same time opened its membership rolls to the entire amusement field. Among the names inscribed on the pioneers roll of TMA are' Al Ruland, New York; J. Gallagher, Boston; John P. Smith, Philadelphia; James C. Parmell, St. Louis; Fred Rihm, St. Paul; James Duncanson, Louisville; Charles Leak, Toronto; Isadore Freeman, Cleveland; J. A. Dohring, San Francisco; William Parker, Cincinnati, Charles Palmer, Toledo; Lee M. Hart and Louis Hemrich, Chicago, and J. P. Carter, Toronto.

The Grand Lodge Theatrical Mutual Associations has weathered the torm through good and bad years and always with its founding principles in mind: Charity, Benevolence and Fidelity. Interest in TMA is running very strong just now, with several new lodges having been formed and some old lodges reinstated. Next TMA convention will be in Omaha in July, 1947. Present Grand President is Philip Hitter, 1687 East 28th St., Brooklyn, N. Y. ★ ★ ★

Studio Projection Engineering

By ARTHUR ROST *and* WALTER McCORMICK

Projection Engineers, Metro-Goldwyn-Mayer Studios; Members, I. A. Local 165

IN THIS busy studio we have 48 projection machines in operation in booths, 9 portable moviolas, 4 process projection booths, 4 process stereopticons, a scoring stage, a synchronizing stage, and both 35- and 16-mm portable equipment. The machines operating from booths are used in conjunction with review rooms or little theatres. The portable moviolas (Fig. 1) are used on stages for scene-matching purposes. Matching is necessary when, by virtue of a retake or any other reason, the duplication of a previously shot scene is required. The specific scene is brought to the stage by the cutter, run on the moviola by the projectionist, and viewed by the director, cameraman, soundman, and those from wardrobe, props, and any other department involved in restaging the scene. Naturally, this saves time and money by eliminating many trips to and from the lot projection rooms.

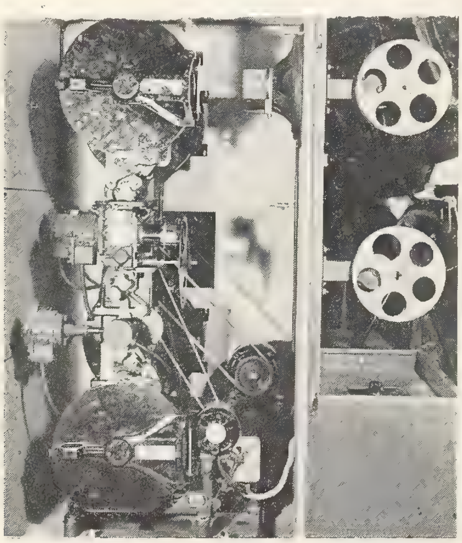
The process projection booths are used for transparency, or rear, projection. The background of a scene is projected on a translucent screen in front of which is a set upon which the action occurs. This is photographed as a unit, resulting in a finished scene which places the locale wherever desired. This type of projection is necessarily very technical and critical. The stereopticon projectors are used for the same purpose, utilizing still pictures or slides instead of film.

The projection on the scoring and synchronizing stages is used to time the scoring of music and the synchronization of effects to specific action in a picture. The portable 35-mm equipment consists of standard portables which are used for off-the-lot screenings and some location work. The 16-mm sound projectors are transformer-coupled from the second audio stage into the 500-ohm fader circuit and the sound is run through the room sound system operating the projector from the booth. We load the output stage with a 16-ohm resistor for termination. When using the projector in this manner the picture is projected through the observation port between the two standard machines.

Very High Standards Maintained

Studio projection equipment, as with that used in the theatre, must be kept in perfect condition at all times. The light on the screen must not vary more than ½ foot-lambert at any time [our standard is 12½ foot-lamberts]; a steady picture must be presented, and the sound must meet the critical Academy standards. One thing which is very important in studio projection is the elimination of scratches on film, as the stock is very green and easily damaged. All idler rollers and fire trap rollers, gates, etc., are highly polished and all shoulders are relieved to give more clearance to prevent scratching of film.

The standard procedure for opening the booths on this lot is as follows: first, the projectionist turns on the amplifier and associated equipment, and while this is heating up he oils and cleans the machines. Then he runs a frequency test track to balance both machines at 1000 cycles,

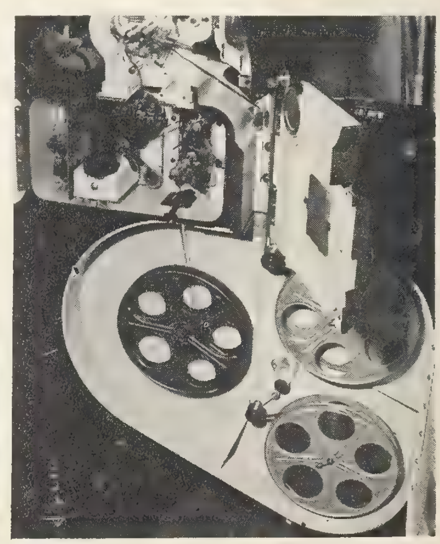


STUDIO PROJECTION AIDS

Fig. 1 (left): portable moviola for viewing specific scenes by production personnel.

Fig. 2 (right): 'Dummy' for dual-film projection of picture and sound tracks. Will take-up either double or single reels.

Fig. 3 (below): adjustable take-up tension nut (open), and hard-felt take-up friction discs.



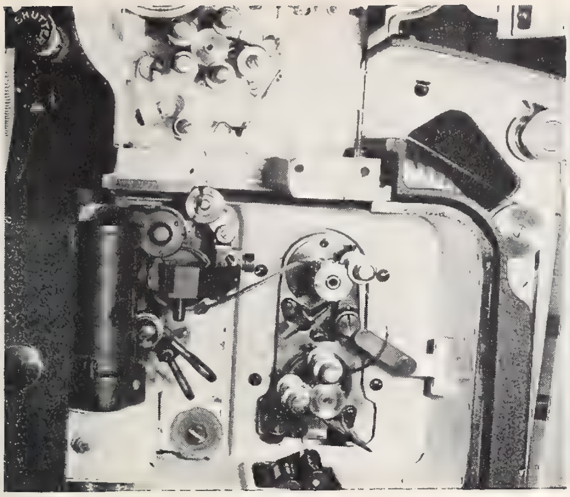


FIGURE 4

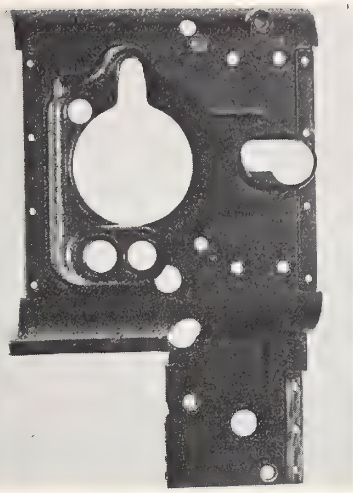


FIGURE 5

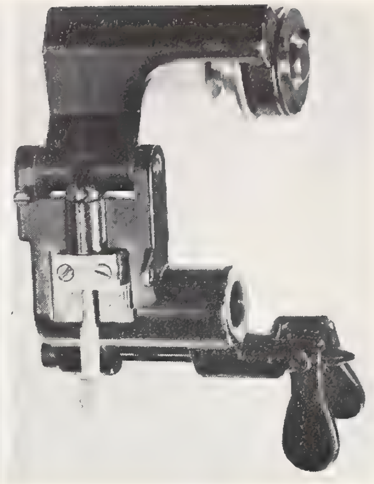


FIGURE 6

followed by a check of all frequencies from 40 to 8000. If this curve varies as much as one db. from his master chart, he calls the projection engineer, as this is the most variance permitted from the Academy standard. Following this he runs both machines and steps into the auditorium and listens for machine noise, flutter, speed variation, overload, rattles, and hum in the system, switching the sound from one machine to the other. When satisfied that the sound is okay, he polishes his mirrors, lenses and ports and projects the light upon the screen. Light on both machines must balance and not vary from the prescribed foot-lambert standard. The entire procedure takes from 30 to 40 minutes, following which the room is ready for the day's running. This pre-run inspection is based on very critical standards.

'Split-Film' Projection Technique

Up to the time the release composite (or movietone) print is made, all studio projection is on dual film (separate picture and sound tracks). This necessitates the use of "dummies" (Fig. 2), which, as can be seen, are equipped to take-up either 1000- or 2000-foot reels. We have developed and put in use an adjustable take-up tension nut which is used when a change in tension becomes necessary (shown open in Fig. 3). In conjunction with take-ups we use hard-felt take-up friction discs (Fig. 3) instead of leather or fibre, which are furnished with new equipments, as the felt gives a smoother pull on the film and does not glaze or develop high spots.

When speaking of separate sound track reels, it should be pointed out that M-G-M prints on both sides of the 35-mm sound track positive. After processing, this film is split and then sent to the projection rooms. This means that the sound is reproduced on 17½-mm, single-sprocket-hole film. That is, the sound is reproduced on what we call "split film" until the picture is re-recorded for preview. The re-recorded track is delivered to the projection rooms on full 35-mm or "wide" film. These variations necessitate several modifications in both the projector and sound head.

The projector head has to be adapted to run split film or wide film from the dummy through the sound head into the lower take-up magazine, using the bottom of the lower projector sprocket to feed the film out of the dummy into the sound head. This requires an idler bracket and idlers mounted in the projector below the lower sprocket similar to the one already on top of the same sprocket. Also, guide rollers are necessary. The front plate has to be cut out to admit the front dummy throat so the film can enter (Fig. 4) and leave. The crank shaft is removed and a new shaft made here is installed which does not protrude through the film side of the head but is held rigid in the frame, the main drive gear turning on the shaft instead of the shaft turning in the head. This also has the good feature of not wearing the bearing hole in the main frame, as so often happens in the original assembly.

A major change made in the Simplex Sound head to adapt it to run 200-mill split film as well as conventional 100-mill wide track is the building of a complete ne optical system. The grinding and testing of these lenses is a very tedious procedure and many crafts are involved. Coupled with this lens system is built a special push-pull photocell divider circuit and box using the 920 photocell. We mount the Simplex Cell Holder Bracket on top of this box, and it is held into place by the 3 screws that hold this bracket now. The electrical circuit is connected through banana pins to a tie-block on back of sound head which ties down the coaxial cable (+ 90V, — 90V) and ground. The servicing of the head, in the event of trouble, is simplified by the use of this method. The foregoing modifications are also shown in Fig. 4. When using the E-7 projector with dual film attachments it is necessary to move the one-shot oiling system to the top of the head on the gear side.

Mechanical, Electrical Interlocks

In many of our rooms we are able to interlock our projectors either mechanically or electrically, thereby enabling us to run a picture and two or more sound tracks at the same time. The mechanical interlock gives very little trouble, but the electrical interlock frequently shears off gear teeth, especially on the spiral shutter gear. This is caused by the jerk the machines get due to the synchronous drive motor not being in phase with the electrical distributor which drives the motors. This drawback is more than overcome by the flexibility of operation of this type of interlock, as it permits the running of a proj-

ector and almost any number of sound tracks at the same time, which is very essential in re-recording a picture.

The re-recording process is the final blending together of the dialogue, music and effect tracks into the finished single-track product. As can be readily understood, the shearing off of teeth on the spiral shutter gear can seriously hamper production unless provisions are made for the speedy replacement of that gear. We have made those provisions by boring out the front plate where the shutter shaft comes through so the pinned collar will slide through, permitting the shutter shaft to be removed without removing the top magazine and front plate. At the same time a similar hole is bored for the removal of the spiral fibre-shutter gear shaft, which makes it possible to replace this gear in 30 minutes (Fig. 5).

Another feature of our re-recording projection rooms is a footage counter which consists of illuminated speedometer-type rotating numbers located above the screen. There is one for each projector, and it is driven electrically and actuated by a micro switch mounted on the side of the projector head. A cam attached to the main drive gear in the head trips the lever on the micro switch every revolution, thereby turning the counter one foot. This enables the re-recording mixer to pick up his cues at certain footages and assists him in getting a perfect "take" with less rehearsals. The film cutters sitting in on the run are able to detect flaws, etc., in their pictures at certain footages, which permits them later to wind down to the exact spot desired without looking for a couple of hundred feet each way to locate the part they want.

Much of our interlock projection is done for the purpose of comparing sound quality. Original dialogue or other tracks are compared with the re-recorded versio of the same tracks. These tracks are run "back to back" or simultaneously on two sound heads. For this comparison we provide the person selecting the tracks with a changeover key in the auditorium. In conjunction with this key are two small pilot lights, one red and one white, mounted at the base of the screen. These lights changeover with the sound, thereby keeping the selector informed at all times as to which track he is listening.

For our operations we have found it expedient to make a couple of other modifications to the Simplex sound heads. One is an adjustable tension on the pad roller assembly which is readily accessible without removing the lens assembly and pad-roller. This consists of an adjusting screw pressing against the spring and ball in the back of the pad-roller, extending down far enough so that the knurled head of the screw can be turned to increase or decrease the pressure upon the film to any desired tension. The pressure upon the impedance drum is very critical in the elimination of flutter and speed variation (Fig. 6).

Projector Head Changes

A change in the soundhead gear train is also necessary, as the local current is 50 cycle. This necessitates installing 50-cycle gears instead of the conventional 60-cycle gears supplied by the factory. In installations employing the electrical interlocks a different problem arises. Due to the fact that the synchronous motors run at 1440 r.p.m. an entirely different set of gears are needed which are made on the outside by a gear manufacturing company and installed by us. One half of the rubber washers (film assembly insulators) on the operating side of the sound head are removed and replaced with sponge rubber. This is done to eliminate any possibility of machine noise. We are permitted *no* machine noise at 110 db gain.

We make one additional change on the Supers that will prove of interest as a service expedient. When the spring on the gate release lever breaks, it is necessary to remove the lens-holder and sleeve to get at the screw holding the release lever. We drill a 3/8" hole in the flat side of the lens slide, expediting screw removal (Fig. 7).

A mixer table is installed in the projection auditoriums which houses the mixer pots, V.I., talk-back and fader (Fig. 8). The talk-back is very superior to a phone system as the projectionist does not have to stop what he's doing to receive instructions from the man at the controls in the auditorium. Projection booth control is shown in Fig. 9. We use 5-inch Jensen speakers (insulated from the cabinet by rubber grommets) working into a specially built amplifier which increases the middle range and cuts off the low-frequency response.

We build a special monitor amplifier using 6V6GT tubes in push-pull and an 8-inch Jensen p.m. speaker on a directional baffle. You will readily see that with this additional gain all machine noise and amplifier noise, hum, etc., will quickly be heard in the booth, and by installing a voice cut-off switch compensated by a 12-ohm resistor, sudden blasts of power are kept from hitting auditorium speaker diaphragms. This change saves hundreds of dollars a year in speaker replacements and sound-checking time.

To keep the machines balanced we use a 2-ohm, 50-watt

(*Continued on page* 83)

FIGURE 7

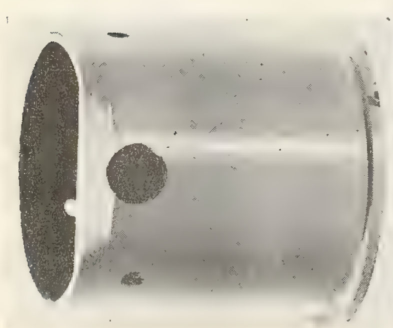
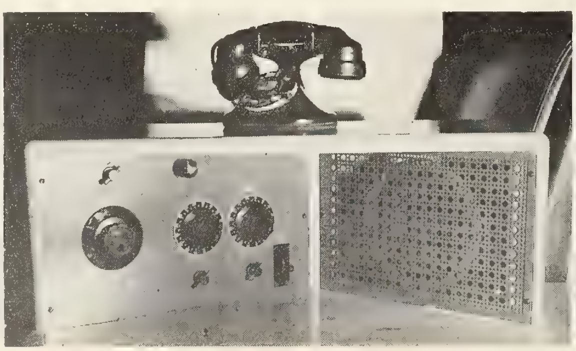
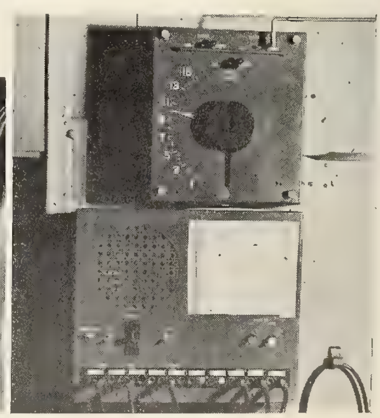
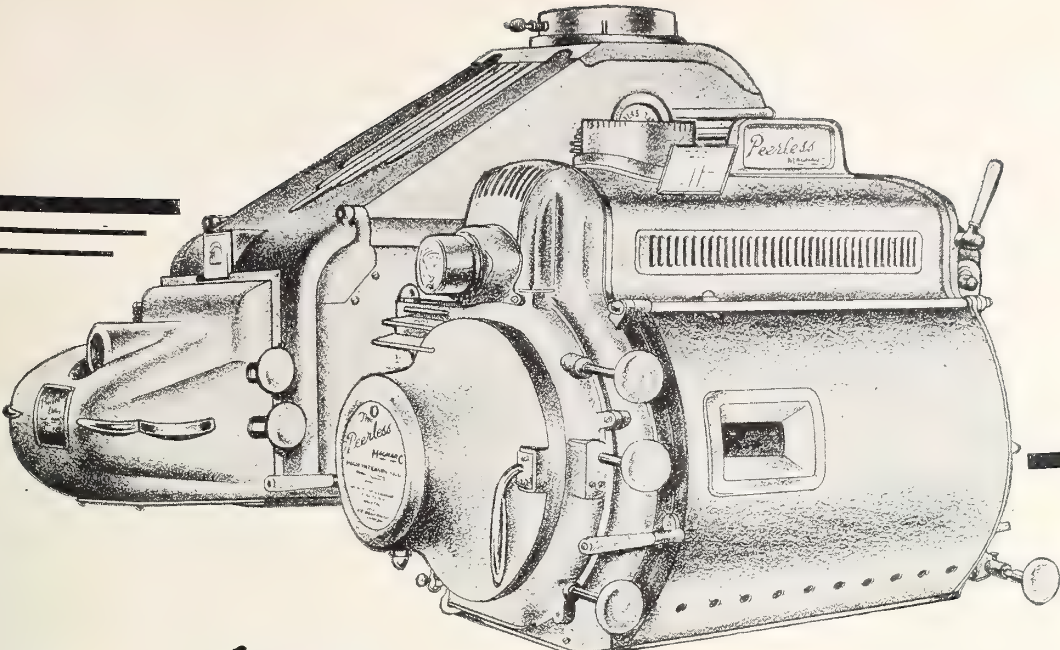


FIGURE 8 (below); FIGURE 9 (right).







Evolution of the Carbon Arc for Projection

By W. C. KALB
National Carbon Co., Inc.

FIGURE 1

Low-intensity, direct-current carbon arc.

FIGURE 2

Low-intensity, alternating-current carbon arc.

MOTION pictures were first shown commercially on screens only a few feet in width and in narrow rooms of small seating capacity, completely darkened except for the red exit lights. These screens were small, but their area was hundreds of thousands of times the area of the light source which the optical system required for projection is capable of utilizing. Obviously, a light source of very high intrinsic brilliancy was needed to supply the required volume of light from the small area which could be used effectively.

It was soon found that the carbon arc was the only available source of light, adaptable to motion picture projection, which possessed sufficiently high intrinsic brilliancy to give an acceptable level of screen brightness. Progress in motion picture projection has, therefore, from its earliest days, centered around the carbon arc and is still closely associated with the intensive and constant research that has brought about the evolution of the carbon arc.

Development of the motion picture industry from its modest beginnning to a point where it ranks as one of the major industries of the country has resulted in demands for much more light and light of much better quality than that supplied by the earliest forms of carbon arc projection lamps. These demands have been met or anticipated by improvements in lamp design and construction, improved optical systems and improvements in the carbons themselves. Theatres have increased enormously in seating capacity and screen widths have been increased correspondingly to provide a picture satisfactory to patrons furthest removed from the screen. Some "Drive-In" theatres now use screens as much as 60 ft. in width. General illumination has also been increased to provide comfortable vision for patrons entering the theatre. These developments have necessitated a corresponding increase in volume of illumination and also in screen brightness.

Ever Increasing Light Demand

Several other factors have contributed to the demand for greater quantity and better quality of projection light. Improvements in the quality of photography have created a demand for higher levels of light in order to obtain most effective reproduction on the screen. Early pictures presented sharp contrast in light and shade with little intermittent gradation of tone, and a relatively low level of screen illumination gave satisfactory reproduction. Improved emulsions permit a wide latitude of tone gradation and the perfection of modeling and detail which characterizes the picture of today. This, in turn, requires a high level of screen illumination for effective reproduction of this photographic quality on the screen. At dusk one can see the outlines of buildings, trees and other features of the landscape but few of the surface details which are clearly visible in stronger light.

Projection follows the same rule. A good intensity of screen illumination is needed for the audience to see the full quality and beauty of the photography. A screen brightness of 9 to 14 ft.-lamberts at the center of the screen is specified by the American Standards Association as recommended by the Projection Practice Committee of the Society of Motion Picture Engineers. At 75% reflectivity this represents a light intensity of 12 to 19 foot-candles at the center of the screen or, with 80% side-to-center distribution, 10 to 16 average foot-candles over the entire screen area.

Introduction of color in motion picture photography has given importance to the color quality of projection light. 35-mm film for theatre use is processed to give accurate color values on the screen when projected with snow-white light, that is, light in which all primary colors are present at essentially equal intensity as in daylight. Projection light of other quality distorts the colors on

the screen and detracts from the impression of reality color pictures are intended to create.

The addition of sound to the visual impression offered the motion picture patron might seem to have no bearing on projection light requirements, but in reality it does. The frame dimensions of the picture on sound film have been reduced from those of silent film to provide a marginal space for the sound track. As a result, with the same optical factors used for silent pictures, a light source of 24% greater brilliancy is needed to project the same volume of light through the aperture and film and produce a screen image of equal area and brilliancy.

Types of Carbon Arcs

Evolution of the carbon arc as applied to motion picture projection may well be considered in relation to the three basic types: the low-intensity arc, the flame arc, and the high-intensity arc. These are defined as follows:

The low-intensity carbon arc is one in which the principal light source is incandescent solid carbon at or near its sublimation temperature. The carbon electrodes may be solid or contain a neutral core of softer carbon.

The flame arc is a development of the low-intensity carbon arc in which the core of the electrode is enlarged and part of the carbon of the core replaced with chemical compositions capable of producing visible radiation efficiently when in a highly heated gaseous form.

The high-intensity carbon arc is one in which this effect is carried much farther so that, in addition to the light from the incandescent crater surface, there is a large amount of light originating in the gaseous region immediately in front of the carbon as a result of the combination of a high current density and an atmosphere rich in flame material.

Low-Intensity Carbon Projection Arcs

The arc stream of the low-intensity d.c. carbon arc emits relatively little visible radiation and only a small amount of light comes from the tip of the negative carbon, but the crater or face of the positive carbon tip presents an incandescent surface of great brilliancy limited only by the sublimation temperature of carbon. This arc is shown in Fig. 1. The earliest projection lamps used solid carbon electrodes with the negative carbons slightly smaller in diameter than the positive. Since there was nothing to fix the position of the arc stream on the face of the positive carbon, it had a tendency to move about and cause flickering of the light on the screen. This tendency was reduced by making the positive carbon in the form of a shell, or thick-walled tube, and filling the central opening with a neutral core of softer carbon.

Further improvement in the steadiness of screen light and elimination of shadow from the negative carbon were obtained by using a long tapered end on the negative carbon. This was soon followed by the use of a metal coated negative carbon considerably smaller in diameter than the positive. The first negative carbons of this type were branded "Silvertip" and a later improved negative bears the trade-mark "Orotip."

The low-intensity a.c. arc between neutral cored carbons of equal diameter (Fig. 2) was used to a limited extent in locations where only alternating current was available but proved far less satisfactory than the d.c. arc. Since each carbon is positive only half of the time, the carbon tips are much less brilliant than the tip of the positive carbon in the d.c. arc. Furthermore, these a.c. arcs were disturbingly noisy.

Early types of projection lamps used a condenser lens to focus the light from the arc on the film aperture. The carbon trim was inclined several degrees from the vertical and the position of the negative carbon adjusted to burn off the positive tip on one side, thus exposing as much as possible of the positive crater to the condenser lens. Fig. 3 shows the arrangement of the carbon trim, lens and film aperture in the old-type low-intensity lamps.

As theatres and screens grew in size, larger carbons and more current were used until positive carbons 1⅛" in diameter with ½" negatives, operated at an arc current of 120-140 amperes, were to be found in some theatres. However, the optics of projection place rather narrow limits on the area of light source which can be used effectively. Larger carbons and higher current produce a larger light source, but all increase of area beyond the limits of the optical system is wasted. Furthermore, once the crater is brought to the sublimation temperature of carbon and its peak brilliancy of about 175 candles per sq. mm., higher current serves only to enlarge the crater and consume the carbon faster without increasing the brilliancy or the light on the screen. Carbons in some of the earlier lamps were operated at a brilliancy appreciably below the maximum possible value.

About 1924 an improvement was made in projector lamp design which provided much more effective use of the light from the low-intensity d. c. carbon arc than that obtained in the early condenser-type lamps. This was the low-intensity reflector arc lamp, the principal of which is illustrated by Fig. 4. The positive carbon, usually 12- or 13-mm in diameter, is mounted in line with an 8-mm negative on the optical axis of the lamp with the positive crater facing an elliptical mirror which focuses the light on the aperture plate. The basic advantage of this lamp over the earlier condenser-type lies in the fact that the reflector picks up and directs through the aperture a 120 degree cone of light from the positive carbon whereas the condenser lens of earlier lamps picked up only a 45 degree cone, as indicated in Fig. 3.

The 12-mm/8-mm carbon trim originally produced for this lamp had an operating range of 21-25 amperes, with 57 volts at the arc, and a total screen illumination without film or shutter of 1850 to 2160 lumens. Improvements in carbons for these lamps have resulted in a 12-mm/8-mm

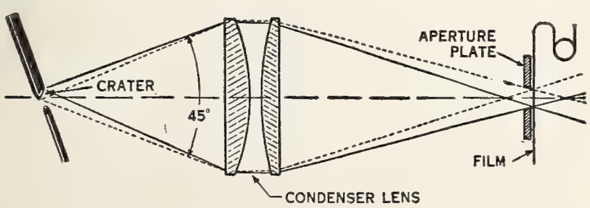
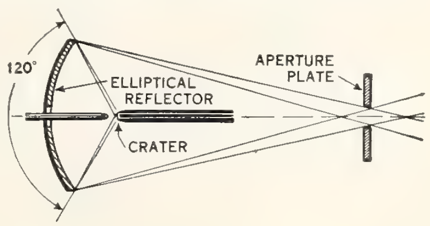


FIGURE 3

Left: condenser type, low-intensity lamp.

FIGURE 4

Right: reflector type, low-intensity lamp.



trim which can be operated at 21-32 amperes, has a positive crater brilliancy of 155-175 candles per sq. mm., and provides 1850-2400 screen lumens when used with an $f/2.5$ untreated projection lens without film or shutter, and with 80% side-to-center distribution of light intensity on the screen.

Development of the flame-type carbon arc permitted marked improvement in the operation of projector lamps on a.c. These carbons came into use for projection about 1917. Carbons of the same diameter are used in upper and lower holders, with the lower carbon held in a vertical position and the upper carbon inclined. The use of flame material in the core of low-intensity a. c. projector carbons greatly improves the steadiness of the light, gives it a snow-white color and eliminates the noise experienced with the low-intensity a.c. arc between neutral cored carbons.

High-Intensity Carbon Projection Arcs with Rotating Positive

By 1918 increase in theatre size and screen dimensions had reached a point beyond the capacity of low-intensity projection lamps then available to provide sufficient screen illumination, and the high-intensity d.c. carbon arc, originally developed for powerful searchlights, was adapted to motion picture projection. The positive carbon of the high-intensity d.c. arc is cored with chemical compositions similar to those used in low-intensity flame arc carbons. This positive is used with a metal-coated negative carbon of smaller diameter, either solid or cored, and operated at a much higher current density than any of the low-intensity arcs. A deep cup-like crater is formed in the tip of the positive carbon within which the luminescent gases released from the core are heated to a very high temperature. This provides a source of light greatly surpassing in brilliancy and whiteness that obtained by incandescence alone from the electrode face of the low intensity carbon arc.

The original types of high-intensity projection lamps used a condenser lens to pick up the light from the arc and the positive carbon is supported on the optical axis of the lamp with its crater facing the lens. The negative carbon is mounted below the positive in an inclined position. Fig. 5 shows the appearance of the arc in a high-intensity d.c. condenser-type of projection lamp. Because of the high current density, the positive carbon is allowed to project only a short distance from its holder and is rotated continuously during operation to maintain a symmetrical crater form.

The carbon trim most generally used in projection for several years was a 13.6-mm positive with a ⅜″ or 7/16″ metal-coated cored negative, operated at 120-130 amperes with 67-69 volts across the arc. Such an arc operated at 125 amperes with the condenser lens originally used, with an $f/2.5$ untreated projection lens and with 80% side-to-center distribution, projects about 5700 lumens on the screen without film or shutter. Improvement of the condenser lens has since brought this value up to 7900 lumens.

An improved 13.6-mm positive carbon was introduced in 1941 which has the same crater candle-power as the older carbon when operated at 125 amperes but is capable of operating at 150 amperes with 78 arc volts using a 7/16″ cored negative. Under the latter conditions the crater brilliancy is 875 candles per sq. mm. Still more screen illumination was made available in 1942 by the development of a 13.6-mm super high-intensity carbon for operation at 170 amperes and 75 arc volts and using a ½″ metal-coated cored negative carbon. The positive crater brilliancy with this trim is about 940 candles per sq. mm.

Along with the increase in crater brilliancy and candlepower, obtained by greater concentration of electrical energy at the arc, there is also increased energy radiated in the form of heat. It is reported that injury to the film may result at the higher arc currents unless some means of protection against excessive film temperature is used. Some of the larger theatres are using heat-absorbing glass filters for this purpose. While such filters reduce the heat in much greater proportion than they do the light, their use, nevertheless, is accompanied by about 20% reduction of screen light. Should it prove practicable to reduce the detrimental effect of heat on the film by means of a well-directed air blast, this reduction of screen illumination could be avoided.

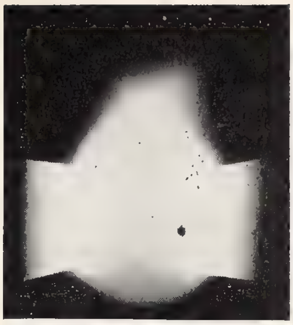
Discovery that the light transmission of the projection lens can be increased by a treatment which reduces reflection at the surfaces of the glass, and the production of projection lenses of greater diameter and having this treatment, have resulted in considerably more effective use of the light produced by the carbon arc. Table A shows the screen light available from the condenser-type, high-intensity projection lamp using 13.6-mm positive carbons of the types here described, with an $f/2.2$ condenser system and a 5″, $f/2.0$ treated projection lens. Data are based on 80% side-to-center distribution of the screen light.

Simplified High-Intensity Projection Arcs

Following development of the low-intensity d. c. reflector arc lamps, a reflecting-type, high-intensity lamp, popularly known as the "Hi-Low" lamp, came into use about 1926. This lamp made high-intensity projection available to theatres of intermediate size. It uses a 9-mm rotated positive carbon, a 5/16″ metal-coated cored negative and operates at 60-85 amperes with 48-58 arc volts. When operated at 75 amperes and 56 volts, the arc conditions in most general use, 5750 screen lumens are obtained

TABLE A. LIGHT OUTPUT FROM 13.6-MM H.I. CARBON TRIMS

	Regular High-Intensity Trim		Super H.I. Trim
Arc amperes	125	150	170
Arc volts	68	78	75
Crater candelpower	43,000	63,000	78,000
Screen lumens without film, shutter or heat filter	11,500	16,000	18,500
Screen lumens with heat filter	....	12,800	14,800



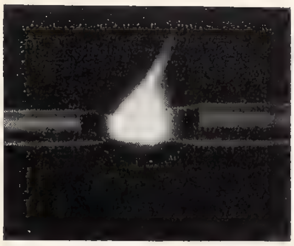


FIGURE 5 (left): high-intensity d.c. carbon arc with rotating positive carbon. FIGURE 6 (upper right): high-intensity a.c. carbon arc. FIGURE 7 (lower right); high-intensity d.c. carbon arc with non-rotating positive carbon.

at 80% side-to-center distribution, without film or shutter, and with $f/2.5$ projection lens.

Development of a new type of high-intensity carbon about 1931, sold under the trade-mark "Suprex," has brought about a striking improvement in motion picture projection in theatres of small and intermediate size, and the general adoption of a much higher level of screen illumination than was previously found in the smaller theatres. Introduction of a successful process of color photography at about the same time stimulated acceptance of this new source of projection light. This is because its snow-white color quality gives to the small theatres the same fidelity of color reproduction which had previously been found only in the larger theatres already using high-intensity projection lamps.

The principal point of difference between these newer high-intensity carbons and the earlier types is that they are smaller in diameter and are copper-coated to provide the needed carrying capacity for high arc current. A core of flame-supporting material is used, as in earlier types of high-intensity carbons. Both carbons are mounted horizontally in a reflector-type lamp. Because of their small diameter, and the position in which the carbons are held, it was found that a good crater form can be maintained without rotation of the positive carbon. Furthermore, the metal coating allows the carbon to be supported at a distance from the arc. These conditions permit a much simpler lamp construction than that required for earlier types of high-intensity lamps with rotating positive carbons.

Lamps of this type were first built for a.c., both carbons being of the same diameter and cored with flame materials. This a.c. high-intensity arc is operated at a high current density with a relatively short arc gap and much lower arc voltage than that previously used for high-intensity arcs. The 8-mm trim, for example, is operated at 75-80 amperes with 24-29 volts across the arc. There is a highly luminous area adjacent to each electrode face and a luminous ball of lower brilliancy bridging the gap between electrodes, as illustrated in Fig. 6. The crater brilliancy of this a.c. high-intensity arc is 360 candles per sq. mm.

On a.c. the light from the arc has a ripple of twice the circuit frequency which, on a 60-cycle power supply, is not noticeable to the eye. However, the lower frequency harmonic between this ripple and the shutter frequency is sometimes disturbing to vision. For this reason the 60-cycle a.c. lamp was soon followed by d.c. lamps operated on the same principle.

In these d.c. lamps the negative carbon is supported in line with the positive but at a slightly lower level and is usually about 1-mm smaller in diameter. A neutral core is used in the negative carbon. The characteristic appearance of this arc is shown in Fig. 7. The trims in most general use are the 7-mm positive operated with a 6-mm negative at arc currents of 42-50 amperes and 33-37 arc voltage, and the 8-mm positive with a 7-mm negative operated at 60-70 amperes and 36-40 arc volts. At 70 amperes this d.c. "Suprex" carbon arc has a positive crater brilliancy of 700 candles per sq. mm. and is capable of providing 9600 screen lumens, with 80% side-to-center distribution, when used with an $f/2.5$ untreated projection lens and without film or shutter. Use of an $f/2.0$ treated projection lens increases the screen illumination to 12,000 lumens.

Extension of the field for economical use of high-intensity arcs to theatres of still smaller seating capacity was accomplished about 1939 by the development of a low-wattage, a.c., high-intensity lamp used in conjunction with a frequency converter which supplies 96 cycle current to the arc. At this frequency one complete light cycle occurs during each shutter opening, so that phase displacement between shutter and power supply has no visible influence on the screen illumination. This overcomes the light fluctuation which was found objectionable in the earlier, 60-cycle, a.c., high-intensity lamps. This 96-cycle lamp used 7-mm "Suprex" carbons in both holders at arc currents of 52-66 amperes with 18-22 arc volts. Without film or shutter, 4300 lumens are delivered to the screen at 65 amperes, with an $f/2.5$ untreated projection lens and 80% side-to-center distribution.

A new negative carbon was developed at about this same period which permits operation of the d.c. high-intensity arc at a lower voltage than was previously practicable. Low-wattage lamps using 7-mm "Suprex" positive carbons and these new 6-mm "Orotip" C negatives were shortly available. The arc is operated at 40-42 amperes and 27.5 volts and supplies 4300 screen lumens without film or shutter, with an $f/2.5$ untreated projection lens, and with 80% side-to-center distribution. Since these lamps and the a.c. lamp described in the preceding paragraph consume little more than 1,000 watts at the arc, they are frequently referred to as "One-Kilowatt" arcs.

Restrictions on the use of copper during the war necessitated reduction in thickness of the copper coating on "Suprex" carbons and operation at arc currents somewhat

(*Continued on page* 70)

Melting Pot of the I. A.: Movie Costumers Local 705

By TED and JEANNE ELLSWORTH

Motion Picture Costumers I.A. Local 705, Hollywood

THERE are few members within the Alliance who are familiar with Motion Picture Costumers Local 705, since we are comparatively a new union in the I.A. The average union in the Alliance is composed of common local groups with similar background and training which gives the officers a common ground in the approach to any question. We feel that the Costumers Local holds a unique position in the I.A. family in that its members represent nearly every race, religion or creed in the world. There is probably as large a percentage of foreign-born members in this Local as in any union in the United States.

We find among the members a number of highly skilled crochet beaders of Mexican descent; Armenian crochet workers; Asiatic turban wrappers; tailors from Russia, Poland, Lithuania and Austria; dressmakers from the fashion centers of Europe; Chinese and Japanese hand workers; colored janitors and fancy pressers, and research experts with various European and Asiatic, military and civic backgrounds. There are technically skilled braiders and art workers who make the peasant costumes peculiar to their Swedish, Norwegian, South American, Turkish or other homelands.

Both Horizontal and Vertical Setups

Then there is a large group of members which may be compared with the ordinary union within the Alliance, being American-born, educated and trained, and those are the costumers who maintain and sort costumes in the vast wardrobe departments of the studios and costume houses. Not only do these costumers handle the research and direct manufacture, rental, purchase, selection and fitting of costumes for all types of motion pictures, but they often assist in designing and creating such costumes.

Studio tailors must make burnooses, Arabian shirts, blouses, pants, vests, fezs, sashes, etc. Work of crochet beaders seen on burnoose. Sometimes this embroidery work is done in gold or other metallic thread.

In Union structure we Costumers differ from any other I.A. local in that we have both the horizontal and vertical types of union. Within the studios we are primarily a craft union, representing all people who make, alter or handle any costumes whatsoever. On the other hand, in the costume houses, among which we have a membership of approximately 300, we have a vertical type of organization. In these houses we represent the entire plant, including everyone from the highly skilled practical designers, millinery experts, period specialists, color control and dye specialists, down to the unskilled laborers, the semi-skilled clerical help, janitors, watchmen, etc.

The Union background of our members is also greatly varied. Here we find many tailors from the C.I.O. Amalgamated Clothing Workers, and dressmakers and ladies' tailors from the International Ladies' Garment Workers. There are a few tailors from the United Garment Workers, and custom jewelers from the International Jewelry Workers' Union. The craft workers come from various A.F.L. unions, and unskilled workers from the laborers and other organizations. We have clerical and laundry workers from independent, C.I.O., and federally chartered A.F.L. unions. Millinery and hat stylists, male and female, are also included with a history of membership in A.F.L. locals and stylist guilds.

Locale, Period Accurately Reflected

The heterogeneity of our members is the cause of many unique problems. Not only are there Orthodox Jews, Roman Catholics, Protestants, and Unitarians, but some are members of weird and esoteric cults which infest Southern California. Politically, we find a wide range, from Communist sympathizers, liberals, radicals, and conservatives to even a few reactionaries who border on the fascist fringe. The job duties and activities of the various members of the Costumers Local could easily be the subject of a separate article. A vast number of specialists exist in the varied groups from our 17-year-old stock clerks up to our 70-and-80-year-old tailors and dressmakers. Briefly, we will try to show the capabilities and type of demand made upon some of our members.

At 20th Century-Fox studio the wardrobe research de-

Showing diverse and complex costuming work. Left to right: 1, complete Far North outfit; 2, Elizabethan costumes require much difficult padding, including symmetricals for shapely legs and tights. Pleated and lace ruffs, and ties by special operators; 3, velvet robes with gold applique done by beaders. Feathers, fur trimming and headpiece by special operators and milliners; 4, all types of period clothes requiring silks, satins, etc. Gold trimming consists of thousands of microscopic gold, silver and colored beads, often embroidered under a magnifying glass, so delicately-wrought and intricately-patterned are these costume accoutrements.

partment, supervised by Mr. Louis Van DenEcker, supplies not only uniform and period research for the costume department but also for many other departments in the studio. During the war, with the large number of training films being made by the U. S. Army, it was not unusual for the military itself to depend upon Mr. Van DenEcker for the authenticity of all uniforms, insignia, and the like. Although we have numerous research experts within our membership, it is the duty of every male and female costumer to do a large amount of research, and to have a vast wealth of technical knowledge which he must use in the preparation and production of the many diverse types of pictures made annually in Hollywood.

The problems of the costumer vary greatly, as he must have an expert knowledge of colors and fabrics because of the peculiarities of Technicolor photography. Synthetic fabrics used during the war years often photograph much differently than is apparent to the naked eye, and through an error in choice of material and fabric much money would be wasted. The costumer must be able to age clothes so as to make a new suit or uniform appear realistically on the screen as an old, worn suit. He must know cost of materials and costs of manufacturing or renting of costumes in order to submit a budget.

He must also have a creative and imaginative mind in order to solve the impossible. A typical example of such a problem arose during the early days of the war when it becaume necessary to make a troposphere flying suit for a U. S. Navy flying picture. The government was conducting a series of secret experiments with this type of suit, and no person was allowed to see or even to talk to the experts who were doing the work.

In this instance, the costumers assigned to do the picture made a thorough study of all flying suits and experiments in high-altitude flying. With this knowledge as a basis, sketches were made and sixteen of the suits were built at a tremendous cost and used in the picture. This was almost a year in advance of the time when the first experimental suit came out of the Dayton, Ohio, laboratory. The difference in construction between the Hollywood-conceived suit and helmet and the final product of the Government was minor, and the completed production was used officially.

Many strange jobs go into the various workrooms in the studio where the problems of trick costumes for such pictures as *Alice in Wonderland*, *Wizard of Oz*, *Green Pastures* and *Midsummer Night's Dream* present themselves to the costumer. During the making of *Wizard of Oz*, the costume for the Tin Man became a major studio worry. Studio property men, tin-working men, metal experts, and even the makers of metal armor (who actually exist in Hollywood) were unable to solve it. Eventually it was taken to Sam Winters, in the studio tailor shop, who quickly solved the problem through the use of metallic cloth and buckram stiffening. Here, too, the Straw Man, the Lion Man, and other fairyland creatures became the costumers' problem.

Our organizational attempts have been extremly difficult due to the problem of bringing together the various crafts, types of people and groups. During 1929 to 1935 we were able to organize as an A.F.L. federally chartered union all of the male and female costumers in the industry. This included only the people who handle the finished wardrobe. In 1937, after previous attempts to join the I.A., we were brought into the organization. Meanwhile, a small group of our members was helping organize the custom-made garment workers in the studios. By 1940 this group also had obtained a federal charter, and in 1941 the organization merged with the costumers, giving us an organization of around 800 members.

Between 1939 and 1941, we were also active in helping the costume-house employees organize. In fact, quite a number became members of our studio local. Here again a federal charter was obtained, and by 1942 the Western Costume Company, United Costume Company, Jack's of Hollywood, and several smaller shops were 100% organized. In August, 1944, this group also voted to merge with the costumers, bringing us another 200 or so members. Since then all of the small costume houses have organized, and an organizational drive is now being conducted among the custom-made tailors and dressmakers in the area. This drive was started by the Costumers Union

(*Continued on page* 88)

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Case History of the Simplex Projector

By MARK STEPHAN

THE Simplex projector of today had its origin away back in June, 1896, when there were employed at the now famous Eden Musee in New York City two "operators" who were destined to loom large in the history of the technical development of the motion picture industry. One of these men was Edwin S. Porter, later to become president of the company manufacturing the Simplex projector the other was Francis B. Cannock, whose wizardry in mechanics encompassed such notions as that "The requirements of machine fitting placed the thousandth of an inch as the limit of latitude; and on important parts ten-thousandths is the requirement."

These two men conceived, built and exploited the forerunner of what is today the Simplex projector. Of particular interest is the fact that Cannock's assistant was Mike Berkowitz, still active as a projectionist at the Capitol Theatre, New York City, and perennial president of the 25-30 Club. Also, Mike still is actively engaged in applying the Cannock formula for precision work to the rebuilding and overhauling of modern projectors.

But preceding the Simplex projector were a series of events which left a deep impress on motion picture technological development and contributed substantially to the present structure of International Projector Corp. These events stemmed from the brain, hand and heart of Nicholas Power. Possessed of great inventive ability and an agile and far-seeing business talent, Nicholas Power built his first projector, the Peerlescope, in 1902 in a little shop on Nassau St. in New York City. This projector was equipped with a gaslight source and was belt-driven directly from the rim of the crankwheel. The film, upon passing through the projector, dropped into a cloth bag, which, however, was soon replaced by a sheet metal box. As much as 3000 feet of film was run into this box in a loose heap, with the ends of each reel left hanging out of the opening to be retrieved later for rewinding.

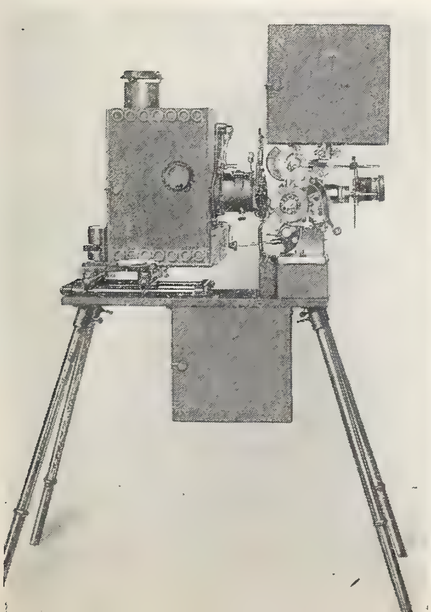
Contemporary with the Powers projector were the Edison Kinetoscope, the Lubin, the Dressler, the Vitascope (built by Thomas Armat and reputedly the first loop-forming mechanism), and the Motioscope, produced by Roebuck and later known as the Motiograph. There were several other "-graphs" and "-scopes" marketed during the ensuing five years, among which was the Standard projector.

Excepting the Motiograph and Standard machines, all of this equipment was extremely crude, although it was used with fair success in the "store shows" of those days. Nicholas Power, however, with his great flair for this type of apparatus, quickly replaced model after model, each succeeding one being a great improvement over its predecessor; and in a short time all of the projector manufacturers, except Motiograph and Standard, were eliminated.

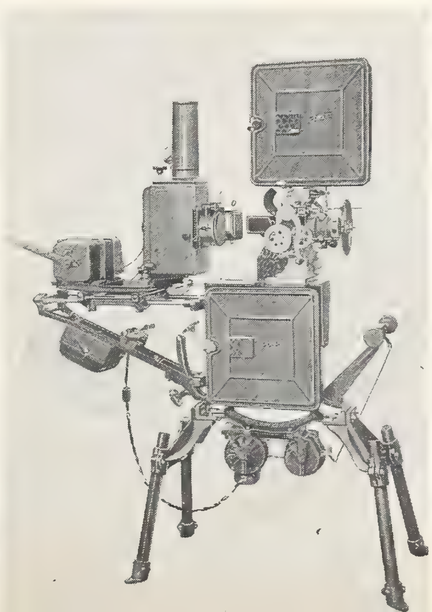
Basis for Success of the Powers

From the beginning Nicholas Power began to build up a strong patent wall around his developments, being the first to invent (1904) a satisfactory device for centering the picture in the aperture while the projector was operating, thus obviating the need for shutting down the equipment and showing a slide very common in those days: "One minute, please, to frame picture." Two years later Power obtained two other valuable patents covering the take-up device, or method of "rolling a film on a lower reel without tearing the film during the operation," and the basic patent covering upper and lower film magazines having fire-prevention film valves.

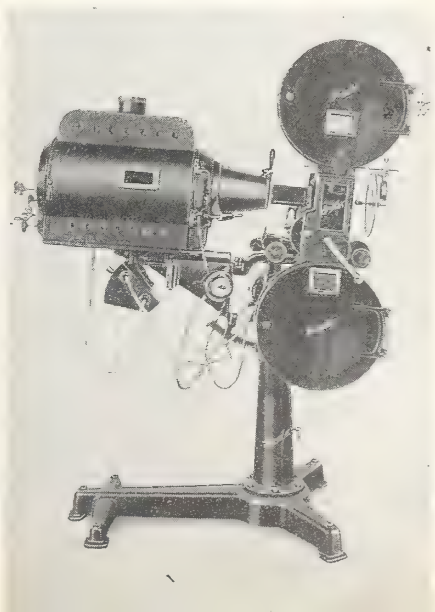
These three patents were the basis for the subsequent success of Nicholas Power and his successor, Nicholas Power Co., a corporation formed in 1907. Between 1904



The famous Powers No. 6 Cameragraph (1909 having a solid-pin movement and employing the then conventional straight arc for illumination.



The 6B was the last Powers made (1920) utilizing a roller-pin cross movement. No. 7 Powers was designed but was never manufactured.



Old standby thru the years—the Regular Simplex (1910). Note old framing lever. Light source shown here is the first McAuley reflector lamp.

and 1922 Nicholas Power obtained 57 patents covering the design and construction of important improvements in Power's projectors Nos. 4, 5, 6, 6A, and 6B, the latter being the last one manufactured. These patents covered many important devices, among which were means for:

> 1. Preventing the breaking of film between the intermittent movement and take-up sprocket. 2. An automatic fire shutter interposed between the film and the illuminant. 3. Further developments and improvements in film magazines and fire-prevention means therefor.

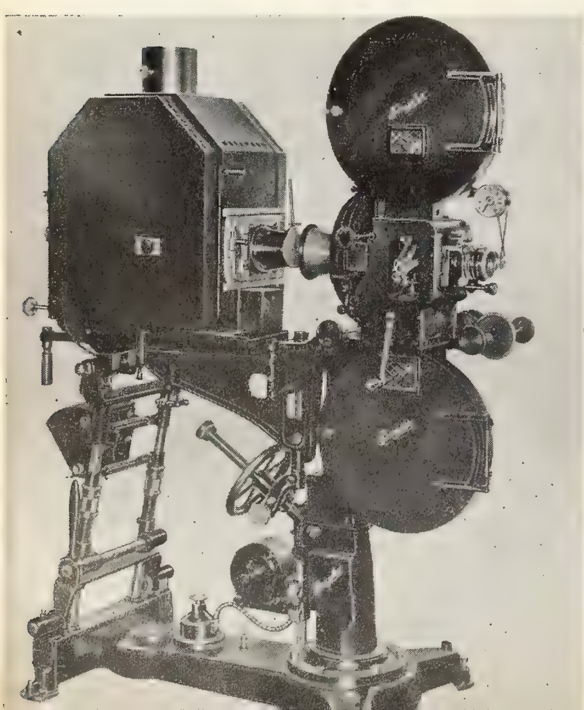
The latter three patents, along with many others, were issued prior to 1914 and apply to the Powers Nos. 4 and 5 projectors.

About 1909 a very important development took place in projector construction: the introduction of the Powers No. 6 Cameragraph which embodied a fundamentally new principle of intermittent movement whereby the film was moved down from frame to frame successively for projection, the period of movement being obscured from the screen, and one picture at a time being exposed to the illuminant; the exposure and cut-off were brought about by a revolving shutter synchronized with the intermittent and this synchronism being maintained regardless of the framing position of the intermittent assembly. This new movement was very much faster in its pull-down period than anything previously attempted, thus allowing a longer exposure to the screen and, therefore, greater illumination. It was this improvement which forced other early competitors, excepting Motiograph, from the market.

While theoretically practical, the first model of this new-type movement was not altogether successful, due to mechanical difficulties, but it was quickly replaced with a device of similar construction which constituted the movement of the most recent and wholly successful Powers projector.

The Powers 6A Marked an Epoch

The Powers 6A projector was marketed in 1911, this being an all-metal equipment including stand, lamphouse, magazines and the No. 6 mechanism, thus eliminating the flimsy wooden tableboard. The 6A enjoyed tremendous succses for many years, the period 1912 to 1916 witnessing many major projector advances of which the following are especially noteworthy: a new stand or pedestal with a new take-up device and means for making what had by this time become necessary adjustments; a new and sturdier lamphouse to handle the increasing demands for higher currents for illuminants; motor-driving means, the fire authorities having then begun to allow the use of such drives; a combination of fire-prevention devices; a mechanical variable-speed control and motor assembly; film tension shoes for projector gates whereby the film was held accurately in the focal plane for proper screen focus of the image; an improved method of framing the image; a lamphouse unit for use with the highly efficient incandescent lamps developed about that time, and a fundamentally new principle in automatic speed-controlling mechanisms for use in conjunction with projector drive motors.



The Super Simplex (1928) with Model M stand and Hall & Connolly H.I. rotating-carbon arc. This was first modern rear-shutter mechanism. Note tachometer used in conjunction with orchestra leader in pit.

Many other patents were issued to Nicholas Power Co., including a great number covering a complete motion picture projector embodying numerous basic ideas and improvements. This new projector was to be known as the Powers No. 7; but it was never put into production. The year 1911 saw only two active projector manufacturers: Nicholas Power Co. and Enterprise Optical Co. (Motiograph). But beyond the horizon was brewing a storm of formidable proportions, the first faint clouds of which were barely visible. The Simplex projector was on the way.

In 1909 two new organizations had entered the field: the Precision Machine Co. which took over the inventions of Francis B. Cannock (shades of the Eden Musee) which were represented by the Edengraph, forerunner of the Simplex projector; and the American Motion Picture Machine Co. which developed the Standard projector. The latter company failed in 1913, however, leaving but three surviving projector manufacturers: Nicholas Power, Precision Machine Co., and Enterprise Optical Co.

The Precision group lost no time in giving strenuous and persistent battle to Nicholas Power Co., and after only three years of intensive competition the Simplex projector was firmly established on the market. Thus was established the basis for the famous Powers-Simplex feud, with the proponents of each projector proving ready literally at the dropping of a word to vociferously, and often militantly, defend the projector of their choice. Particularly avid to do battle for their favorite projector were projectionists, with many an all-night session being devoted to recitals of the comparative merits and demerits of both mechanisms. There can be no question as to who put over the Simplex projector: it was a straightaway job by Mr. Projectionist.

First Simplex Scored Many Advances

The Simplex projector was of entirely different design from the Powers in that it was a considerably more compact mechanism completely enclosed, being on a pedestal of entirely new design and having a great many features which appealed tremendously to the projectionist. Precision also built up an excellent patent structure covering, among many others, the following salient features:

> 1. The basic patent covering the entire equipment and including the new framing device by means of which this operation was accomplished by rotating the intermittent casing about the intermittent sprocket axis.
>
> 2. A new method of focusing lenses on projectors.

(*Continued on page* 90)

Paramount Studios

Old and new lighting methods admirably illustrated on "The Perils of Pauline" set, showing replica of early-type outdoor stage which utilized sunlight for a light source, diffused by muslin. Illumination here consists of banks of controllable carbon arcs. Technicolor camera is mounted on a travelling dolly; in early days it would have been stationary.

'If it Isn't c

EMOTIONALLY, the characters and the story are the most important factors in motion pictures, but technically the entire subject is based on means of controlling the intensity and color of light. A common phrase often heard in projection rooms all over the country is, "If the picture isn't on the film, you can't put it on the screen." A suitable addition to that true statement is, "If the light isn't on the motion picture set, you can't put the picture on the film."

A motion picture is largely an appeal to the senses through vision, and vision is the ability to apprehend light and color. The success of modern cinematography is based upon the ability of the cinematographer to control the intensity and quality of light on the set much the same as a painter controls the color and amount of pigment he uses in his art. If the cinematographer be restricted in the use of proper lighting equipment, his finished product may appear like a skeleton, without flesh and color.

Early Artificial Lighting for Sets

In the early days of motion picture production sunlight was the only available light source and sets were photographed on open stages covered with muslin diffusers mounted on wires so they could be adjusted to control the light. Various types of reflectors were also used to redirect the rays from the sun and avoid heavy shadows on the faces of the characters and throughout the set. Because pictures were made in black-and-white the question of color quality was not so important as it is today where many pictures are produced in full color. However, the cinematographer was handicapped by wide variations in intensity and position of his sunlight source throughout the day, and during inclement weather he was unable to work at all.

As a natural outgrowth of this technique, glass stages, similar to large greenhouses, were constructed and diffusers were installed as on the open stages. The reason for the glass stage was to permit the picture companies to operate during inclement weather; however, the advent of artificial lighting at about the same period made them obsolete and they were seldom used in the manner for which they were originally designed. The advantages of working under artificial light were so great that most of the sets built inside the glass stages were covered over with canvas, or other means were employed to exclude the natural light. Later the glass panels were painted black so the natural light could not interfere with the controllable artificial illumination being used.

Some of the earliest attempts at flood lighting sets were made with old street-type carbon arc lamps and banks of Cooper-Hewitt tubes.

The need for a light source which would project light for considerable distances, thereby giving the cinematographer the ability to create sunlight effects, shadows, the illusion of depth and to model the characters, resulted in the use of large numbers of units adapted from the theatre. Theatre spots with plano-convex condensers and vertical hand-operated carbon trims were used extensively for many years. The floodlights, or broadsides ("broads") were largely of the type used in photo-engraving, but many types of theatre stage lighting units were also used for this purpose. The "Sun-arc" was an adaptation of the military searchlight to cinematography, and the 36-inch Sun-arc is practically the only type of adapted unit still in use: it still has some value on extremely large sets.

While some incandescent floodlighting equipment was used at about the period of World War I, this type of light source did not become popular until many years later. The film emulsions used in the early days were of comparatively slow speed and the light sensitivity was restricted toward the blue end of the spectrum. Incandescent lamps found very little use because the radiation of that type of light source is largely in the red and yellow

Showing details of parallels for various lights, and some control devices in front of lights in left foreground.

Paramount Studios

e Film . . .'

By PETER MOLE
Mole-Richardson Company, Hollywood

20th Century-Fox Studios

Foreground carbon arc lighting equipment on "Carnival in Costa Rica" set. The number and variety of lighting units, and their careful positioning, is well-nigh incomprehensible to non-production motion picture workers.

end of the spectrum. Later, however, black-and-white film was made panchromatic, sensitive to all colors, and incandescent filament lamps were added to set lighting equipment.

First M-R Fresnel-Type Lens

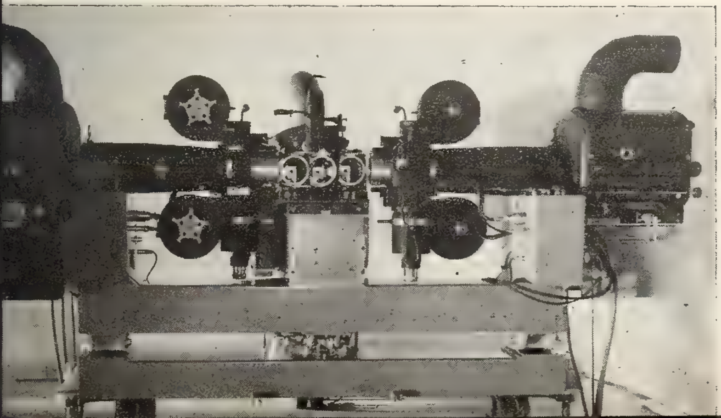
The introduction of the M-R Fresnel-type lens in 1934 marked the arrival of the first piece of set-lighting optical equipment designed exclusively for cinematography. All of the older lamps, made obsolete by the Fresnel-type lens, were adaptations of equipment made for other purposes. Both the plano-convex lens and the parabolic mirror produce a very dark spot in the center of the light beam when the unit is at full flood position. This defect is overcome with the Fresnel-type lens which is so designed as to deliver a smooth field of light within the limits of 10° to 60°. The efficiency of this lens is many times that of the plano-convex, and the M-R Type 90 H.I. Arc at 120 amperes will even surpass the light output of the 150-ampere Sun-arc flooded a very few degrees.

The advent of modern full-color cinematography brought with it a number of new lighting problems. To visualize them it is only necessary to consider that in black-and-white cinematography light creates film density which is merely a medium to control the intensity of the rays from the projection light source. The audience gains the illustion of a picture by variations of light and shade. In color, however, it is also necessary to use a light source containing the three primary colors of the spectrum in order to produce color, hues and tints. Because white light is made up of equal quantities of the light primaries—blue, green and red—it has been chosen as the source for professional color cinematography. The use of white light for interiors also simplifies the process because sunlight is white light and the same film may be used on exteriors as on interiors.

If the projection light source contained no blue, there would be no blue on the screen regardless of the color of the film. The same is true of the light sources used in set lighting. The color is in the light, and the objects serve only to *selectively* reflect the various rays from the light source to the film in the camera.

Paramount's triple projector superimposes three identical prints onto one screen thereby increasing the light almost threefold.

Transparency Dept., Paramount Studios



Color Cinematography Requisites

In black-and-white cinematography the absence of light results in a black image on the screen which in many cases is accepted by the viewer as an intended shadow. Under adverse lighting conditions a character in a dark suit may appear only as a face, hands and a white shirt with no detail whatever in the suit; still the viewer will accept the result. The foregoing is not true with color. Here the absence of light is also black; but if a character wearing a dark-colored suit moved into an area where the light level was too low, the suit would appear black, which would not be acceptable to all. The same thing could happen to a colored dress with deep folds where the absence of light in the shadow areas might make it appear as having black stripes.

In the early days of color the somewhat lower latitude of the process brought forth some proponents of flat lighting. It was their contention that the sets should be illuminated with highly diffused light sources, the differences of intensity reduced to a minimum, and that color itself would provide the necessary depth and contrasts. As a matter of fact, modern color has brought about demands for lighting equipment with much greater scope than was previously dreamed of with black-and-white. Brilliance, volume, color, penetrating power, and controllability have all been vastly improved in modern lighting equipment.

Inasmuch as white light, or sunlight, quality is required for color, the only unfiltered light source to completely meet the requirement is the Duarc-type carbon arc broadside lamp which provides a smooth, general-purpose light. This twin-arc lamp, rated at 40 amperes and 40 arc volts, is used for floor lighting to build up front light, for lighting backings from overhead, and in other positions where projected light is not indicated.

The rotating type, high-intensity carbon arc spotlamps,

Paramount Studios

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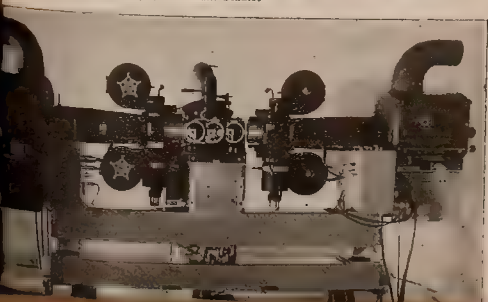


Color Cinematography Requisites

In black-and-white cinematography the absence of light results in a black image on the screen which in many cases is accepted by the viewer as an intended shadow. Under adverse lighting conditions a character in a dark suit may appear only as a face, hands and a white shirt with no detail whatever in the suit; still the viewer will accept the result. The foregoing is not true with color. Here the absence of light is also black; but if a character wearing a dark-colored suit moved into an area where the light level was too low, the suit would appear black, which would not be acceptable to all. The same thing could happen to a colored dress with deep folds where the absence of light in the shadow areas might make it appear as having black stripes.

In the early days of color the somewhat lower latitude of the process brought forth some proponents of flat lighting. It was their contention that the sets should be illuminated with highly diffused light sources, the differences of intensity reduced to a minimum, and that color itself would provide the necessary depth and contrasts. As a matter of fact, modern color has brought about demands for lighting equipment with much greater scope than was previously dreamed of with black-and-white. Brilliance, volume, color, penetrating power, and controllability have all been vastly improved in modern lighting equipment.

Inasmuch as white light, or sunlight, quality is required for color, the only unfiltered light source to completely meet the requirement is the Duarc-type carbon arc broadside lamp which provides a smooth, general-purpose light. This twin-arc lamp, rated at 40 amperes and 40 arc volts, is used for floor lighting to build up front light, for lighting backings from overhead, and in other positions where projected light is not indicated.

The rotating type, high-intensity carbon arc spotlamps,

represented by the Types 90 and 170 M-R units, require light straw-colored gelatine filters over the Fresnel-type lenses to reduce the slight excess of blue. This type of unit provides the bulk of light for modern color cinematography because of the scope of light volume and even field of distribution of the light which may be obtained at various beam divergences with different carbon trims, and because of accurate light control made possible by the small size of the brilliant carbon arc source.

The Type 90 M-R unit is rated at 120 amperes and 56 arc volts; the Type 170 M-R lamp at 150 amperes and 67 arc volts. At the time this article is being written, a higher powered unit of the same type is being completed which carries a rating of 225 amperes and 75 arc volts.

Incandescent tungsten filament lamps can be used with blue filters for color photography when lighting small sets and are frequently used for fill light in closeups, and in small areas where it is difficult to use the larger carbon arc units. The largest tungsten filament lamp in general use is 5 KW. The tungsten filament lamp finds its greatest use in black-and-white cinematography where the added scope of the carbon arc unit is not so essential as in color.

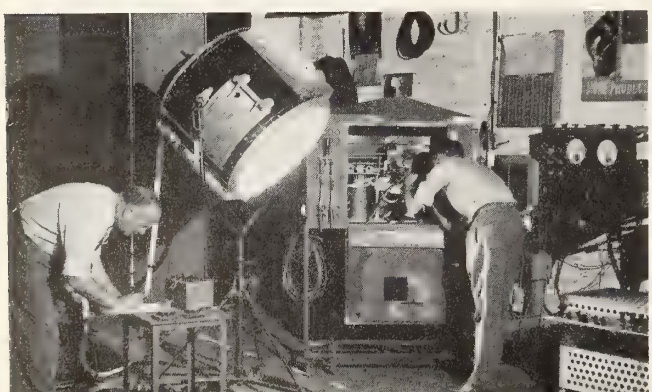
Physical Setup for Lighting Units

The old adage of "Light for the shadows and let the highlights take care of themselves" is no longer used. The modern cinematographer lights for the "action," which is most important. He adjusts the "key light," the illumination falling on the face of the principal character, so those reflected rays will make suitable density on the film, then he accurately balances the illumination in the highlight and shadow areas for the artistic effect he wants. His ability to create the desired dramatic illusion is the measure of his worth. Is it surprising, therefore, that he should demand the best in lighting equipment?

In the physical arrangement of lighting equipment many of the various units are placed on parallels at the top, back and two sides of the set. The balance are located on the floor in front, behind doors and windows, and on the floor in back where they are directed on backings.

To the chief set electrician goes the important responsibility of roughing in the units. Usually he has worked with the chief cinematographer before, and he knows just about the types, numbers, and positions of lights for the work in hand. After this preliminary arrangement has been accomplished, the cinematographer supervises the lining up by ordering changes in direction and intensity of the various units. He establishes the key light, then works for a balance which will provide backlight to make the characters stand out from the walls, to create the illusion of sunlight through the windows, to bring out points of interest and to obtain artistic contrasts. In other words, he paints with light.

A section of Mole-Richardson Co.'s development laboratory, showing test equipment and a new-type carbon arc set lighting lamp undergoing final tests.



When consideration is given to the fact that characters are moving with almost split-second precision and camera angles are constantly changing, it is easy to understand the myriad of lighting problems which confront the cinematographer. He must not only have lighting tools in sufficient numbers, he must also have modern equipment and manufacturing organizations capable of producing new units to supply his constantly changing needs.

'Cone Effect' Analogy in Lighting

In modern cinematography, cameras are often mounted in a crane or traveling dolly in order to keep the main character the point of high interest without restricting action. This technique is amply illustrated by the so-called "cone effect" analogy. The cone method of describing cinematography is an interesting one because this method takes into consideration all of the factors leading from the main action on the screen to the illusion created in the minds of the audience. In this method the observer is considered as though he were looking toward the small end of a cone at the extreme point of which is the face of the character who is portraying the action.

To obtain this effect the cinematographer must skillfully illuminate the set to avoid anything sufficiently bright to detract from the main action, yet he must create an interesting and well-modeled background with sufficient backlight to give the illusion of depth. As the main character moves across the set the point of the cone must move with him.

Following this effect still further, the theatre auditorium must be so illuminated that lights, colored or otherwise, will not create a distraction. There must also be sufficient brilliance in the projection light source to overcome the general auditorium illumination and make the picture the point of high brilliancy. It is ony when all of these factors are coordinated that the correct illusion is obtained.

Process Projection Light Requirements

A specialized department in cinematography and projection requiring large quantities of accurately controlled light is the process projection system for inserting action backgrounds into sets built on the studio stages. In this process a translucent motion picture screen forms the background of the set. In lighting the foreground care is taken that no stray light will reach the front of the screen. At a suitable distance behind the screen a powerful projector, operating with carbons which burn as high as 225 amperes and 75 arc volts, projects a picture onto the screen, thereby forming an action background for an otherwise inanimate set. This action may be the scenery viewed through a train window, the traffic behind a car on a Paris street, or an ocean background for creating the illusion of a ship at sea.

The camera on one side of the screen is synchronized with the projector on the opposite side by means of interlocking synchronous motors.

With the foreground area illuminated to the proper in-

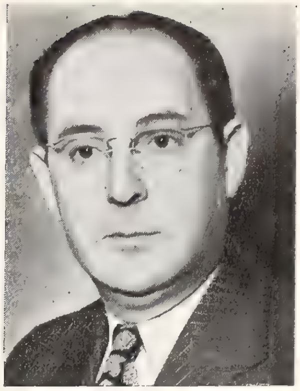
(*Continued on page* 81)

congratulations

and best wishes
for continued success!

Fanchon & Marco

Theatre Technical Service on a Nation-Wide Schedule



By ADOLPH GOODMAN
Assistant Manager, RCA Service Company, Inc.

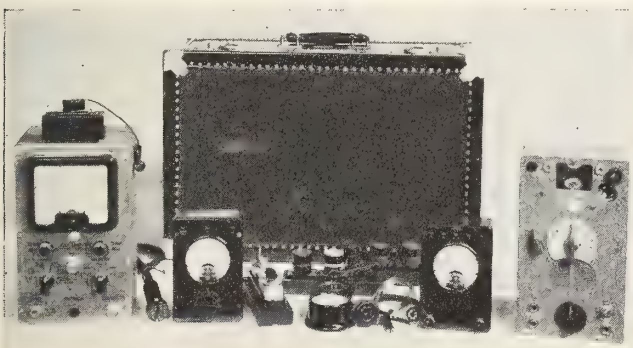
IN 1928, when sound came of age in motion picture theatres, RCA formed a service organization which was the nucleus of the present Theatre Service Department of RCA Service Co., Inc. During the intervening years this organization kept pace with the growth of the theatre industry and has expanded to its present nation-wide coverage, including every State in the Union. Service to theatre sound equipment follows the tradition of the theatre, "The show must go on." This has been the watchword since 1928 and will continue to guide service activities in the future.

The exhibitor has a large investment in his theatre property: he makes his theatre attractive by comfortable seating, restful interior decorations, air-conditioning, and the showing of the best pictures obtainable. Once his patrons are in the theatre he is vitally interested in maintaining a continuous presentation on the screen. Not only does he want to avoid lost show-time but he also wants his equipment to operate at peak performance to build patron loyalty. Every exhibitor realizes that good showmanship demands realistic and life-like sound reproduction.

Nation-Wide Servicing Structure

The projectionist carries the greatest burden of this responsibility. He is backed by the trained field engineers of a national organization such as the RCA Service Co. Both projectionists and field engineers have performed a remarkable job in advancing the art. However, like so many others on the firing line, quite often they are not given the credit due for a job well done.

Behind the scenes of a nation-wide service organization, planning must be streamlined to give the best service at the lowest cost possible. This requires eternal vigilance —trouble caught at its inception and corrected before it becomes a major problem. To spot such trouble, no matter how minor, the field engineer must perform a thorough job on every service call and leave nothing to chance.



Compact postwar RCA theatre service kit. Left to right, in foreground, are battery-operated Voltohmyst, power level indicator, ammeter shunt, tube socket selectors, D.C. ammeter, and triatic signal tracer and capacitor checker. Reinforced fibre carrying case in background.

RCA's service organization is directed from Camden, N. J., the home office, with field operations carried on through eleven district offices strategically located throughout the country. In the home office, general service policies are formulated. Here are also located our accounting and purchasing departments and the warehouse for stocking replacement parts. Always available to the service organization are the research facilities of RCA Laboratories, located at Princeton, N. J.

At the home office there is maintained a technical staff whose functions are to prepare and distribute technical data relating to RCA sound equipment and that of other manufacture, since the field organization services nearly every make and model on the market. This technical group is in close contact with the research engineers, design engineers, commercial department and outside technical organizations such as the Academy of M. P. Arts and Sciences and the S.M.P.E. The group acts as a clearing house for technical problems submitted by field engineers, so that solutions are quickly found and disseminated to all field engineers at the same time. Advance information on new theatre service developments is issued frequently.

District Field Office Operation

Training programs, on a nation-wide scale, are developed so that uniform methods can be employed by every field engineer. During the war many problems dealing with substitutions and modifications of equipment, because of the scarcity of parts, were solved. Such information was instantly forwarded to the field men. Thus, standardized methods were employed to overcome acute material shortages, resulting in great savings in time and material.

Field engineers report to eleven district offices located in Boston, New York, Philadelphia, Atlanta, Pittsburgh, Cleveland, Chicago, Kansas City, Dallas, San Francisco, and Los Angeles. Each office is under the direct supervision of a district manager, with a clerical staff to assist in administration work. In addition, each district has one or more field supervisors and a relief engineer who spend the greater portion of their time in the field. A parts stock is maintained at each office and in various other locations throughout each district, so that emergency replacements will be quickly available.

The field engineer has a certain definite territory which he covers on a prearranged schedule for rendering service calls, and he is responsible for the operation of the sound

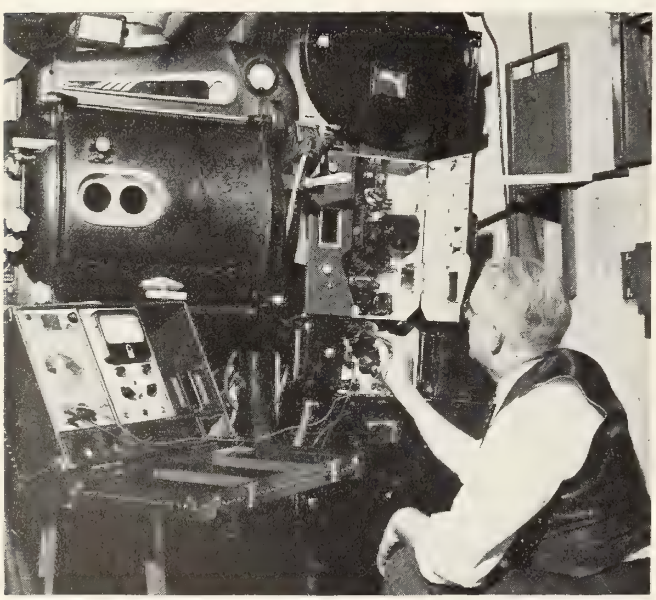
equipment in the theatres on his schedule. In the engineer's headquarters town use is made of the local physician's telephone exchange, or other special facilities, so that he can be located quickly should an emergency occur.

Each month, the district office, in conjunction with the engineer, prepares a schedule which the engineer follows in covering his territory. The exhibitor is notified by postcard of the date his theatre is scheduled to be serviced, so that he can make necessary arrangements in advance of the engineer's arrival. Where a deviation from the schedule is necessary, the exhibitor is notified by the engineer. The services available cover all types of equipment, regardless of manufacture, and all types of theatre operation. Service calls may be rendered twice a month to the de luxe type theatres, and once a month or once every two months to other theatres, with emergency service included.

As an additional feature, a replacement parts plan for both projection and sound equipment is available. For a flat sum, payable weekly or monthly, the exhibitor receives all necessary replacement parts required due to normal wear and tear. Usually, such parts are ordered directly by the field engineer after consultation with the projectionist. The parts are shipped directly to the theatre, without necessity for the exhibitor taking any part in the transaction; thus, he is relieved of any worry concerning his equipment and can devote his time to managing his theatre.

Many exhibitors avail themselves of the portable emergency amplifier systems leased by RCA. This unit can quickly be connected in place of the main amplifier, should trouble occur, and will carry the show until the field engineer arrives to correct the trouble. An emergency amplifier in a projection room is a source of great relief to the projectionist when something goes wrong in the main amplifier system.

Field engineers make initial installations of equipment regardless of manufacture. Equipment specifications are available to them to insure that the sound reproduction meets the manufacturer's standards. During the original installation, the field engineer makes all required mechanical and electrical adjustments to obtain optimum reproduction. While good acoustics in the theatre are a prerequisite for best reproduction, most sound equipments have sufficient leeway to enable the field engineer to fit the reproduction to off-standard acoustic conditions. Such adjustments do not overcome defects in acoustics, of course, but they do permit reproduction nearer desired standard. Such adjustments require considerable skill and years of experience on the engineer's part.



Precise measurements and adjustments are accomplished quickly by serviceman using modern electronic measuring instruments such as the triatic signal tracer shown here.

Field engineers have a large fund of technical knowledge concerning the general operation of theatres, gained from their years of experience in contacts with the industry, relating to such problems as projection, air-conditioning, seating, acoustics, etc. For example, when acoustic treatment is required, the field engineer commands the facilities of our consulting service in the home office. From data supplied by the engineer, an engineering recommendation is made for the particular theatre, giving exact details on acoustic treatment to remedy defects. This service is offered at no additional charge to theatres having service agreements.

Joint Projectionist-Serviceman Aid

RCA recognizes the important part the projectionist plays in theatre operation. Through the close contact maintained between projectionists and field engineers have come many of the major improvements in equipment. Suggestions submitted by projectionists through field engineers are studied and applied wherever practical. The joint efforts of these two groups have contributed to the simplified and streamlined sound equipment of today, with convenient operating controls and meters, and easy accessibility for servicing and trouble-shooting.

To keep projectionists more fully informed on the technical phases of sound equipment, RCA during the war years prepared and made available three editions of a projectionist's handbook covering such subjects as optics, acoustics, amplifiers, projection equipment, and conservation. In 1945 the Theatre Television Handbook was widely distributed to projectionists and local unions. For locals wishing to set up a television study course, there was available the "Introductory Experiments for Television Projectionists." This material filled a long-felt need in giving to the craft the first up-to-date technical data on this important subject. The demand for this material exceeded original expectations and indicated that projectionists, in general, are anxious to learn and develop with the industry. Such a response is gratifying and points to the future well-being of the craft.

Modern Test Instrument Kit

While fully trained and experienced field engineers under good supervisors are a prerequisite for efficient service operation, adequate and modern test instruments must be utilized. Constant research, both in the laboratory and in the field, has proved to be the only way to keep abreast of test instrument requirements. The constant aim in this important phase of service has been to equip field engineers with a minimum of instruments to enable them to perform accurate and precise measurements. Also of primary importance in the development of test apparatus is the necessity for quickly locating and diagnosing faults in case of emergency.

These important considerations have guided our home office technical group in the development of the modern

(*Continued on page* 75)

Projection Arc Lamps—Then and Now

By HARRY H. STRONG
The Strong Electric Corporation

SINCE the very beginning of motion pictures the carbon arc has been conceded the ideal projection light source because of its high intrinsic brilliancy and the fact that the area of this light source lends itself particularly well to the design of an optical system which will project a large volume of light through the film aperture. The early lamps employed a hand-fed vertical burner mechanism set behind a pair of condensing lenses arranged to pick up a 90° light angle from a 60-ampere arc and focus this light through the film aperture to project about 500 lumens of light to a screen 10 feet in width, resulting in a screen brilliancy of about 3 or 4 foot-candles as measured with the shutter running. The overall power consumption was about 6 kilowatts.

Since most of these early theatres were in the direct-current district of the larger cities, it was common practice to connect the arc direct to the direct-current power leads through cast grid ballast resistors. However, many an old-time projectionist tells of temporary installations in which they used a barrel of salt water in which were immersed two horseshoes, as electrodes, fastened to the two lead wires as an improvised ballast resistor.

The problem of the neighborhood theatres, which were in the alternating-current districts, became more involved since the carbon arc operating at 60 or 80 amperes on alternating current was unstable, difficult to handle and required constant attention. This led to the development of a special white-flame carbon which employed certain metallic salts to stabilize the arc, improve the color of the light and reduce the roaring noise of the alternating-current arc—much to the relief of the projectionist. Then followed the Compensarc, which was simply an adjustable step-down auto-transformer which eliminated the tremendous waste of electric power occurring in the ballast resistor. These Compensarcs cut the power bills by more than half, to say nothing of eliminating the heat which made projection rooms unbearable in summer.

Among the early developments employed to secure more light with less current was a small horizontal reflector-type arc burner mechanism imported from Germany. This employed a spun-metallic reflector about 6″ in diameter. It was not a complete lamphouse but rather a hand-fed carbon arc. This burner was installed in the old lamphouses after the vertical burner mechanism was removed. With each installation it was necessary to have a small motor-driven polishing wheel which was used each day to polish the nickel-plated reflector. These small 20-ampere, reflector-type burner mechanisms projected as much light as the conventional 60-ampere vertical arcs employing condensers.

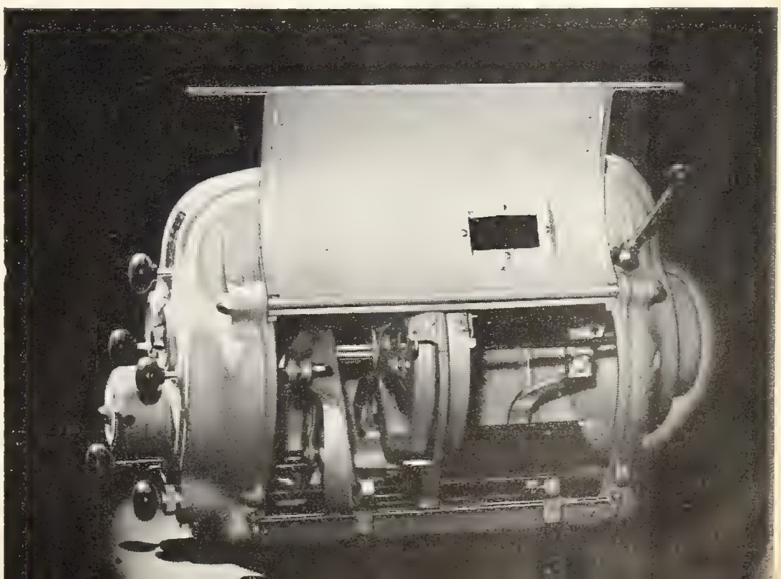
About 1913 there was a trend toward the building of larger theatres showing pictures of enormous size, made possible by the development of the condenser-type Sunbeam arc employing a new type high-intensity carbon burning at 100-130 amperes. However, the overall cost of current and carbons was beyond the means of moderate-sized theatres so that rapid developments followed in the highly efficient conventional low-intensity reflector-type lamphouse. These low-intensity lamps employed silvered glass reflectors and burned small neutral-cored carbons at 20 amperes. These lamps, equipped with automatic arc-feeding mechanisms, within a few years replaced all the vertical arcs previously in general use.

Then followed the development of the hi-lo lamp, introduced just before the advent of sound pictures. This lamp in principle was similar to the low-intensity type in that it employed a reflector 12″ in diameter but burned 70-ampere high-intensity carbons which were arranged in a horizontal coaxial alignment to project a snow-white light in sufficient volume to present acceptable pictures on the early-type sound screens.

Subsequent lamp developments toward higher efficiencies and more light followed the introduction of the high-intensity Suprex carbon which employed a copper coating to carry the currents up to 65 amperes without "penciling." These new reflector-type lamps projected up to 10,000 lumens of pure white light which was sufficient for projecting pictures up to 24 feet in width. Their original first cost and relatively high overall operating costs, however, limited these lamps to theatres of 1,000 or more seats.

In an attempt to meet the needs of the smaller theatre operating on a limited budget there was devolped the A.C. high-intensity, reflector-type lamp. This lamp was short-lived and soon was superseded by the 1-kilowatt, direct-current lamp because of the latter's improved optics, better operation of the small Suprex-type carbons which burned very stable on 40 amperes at 28 volts and the fact that it projected twice the light of the low-intensity lamp at about the same operating costs. Because of their high efficiencies, stable operation and snow-white light, the automatic high-intensity, reflector-type lamp, employing Suprex-type carbons are now standard equipment in most theatres, the 1-kilowatt, 40-ampere lamp in the small theatre with screens up to 18 feet in width, and the 65-ampere lamp in theatres with larger screens.

The Strong 'Utility' lamp, door open, showing arc alignment.



Present and Future 16-mm Projection

By E. W. D'ARCY
Chief Engineer, DeVry Corporation

FUTURE development of 16-mm professional projectors received a tremendous impetus through the demands of the Armed Services for a sturdier type of projector capable of withstanding inordinately bad field conditions; and this demand culminated in a common effort by motion picture engineers to produce specifications for a 16-mm projector having professional quality. These specifications, with the implied keen interest of the Government therein, spurred 16-mm manufacturers to evolve basically new designs pointed toward performance characteristics identical with those of professional 35-mm equipment. In addition, the financial support received through Government contracts, plus the certainty of selling a high-quality projector to a discerning purchaser, resulted in the solution of most of the problems incident to the attainment of greatly improved performance.

A by-product of the development has been the production of adequate test film for checking projector performance, which has aided materially in attaining this specification. Thus, we now have in the 16-mm industry test film that is the counterpart of that available for 35-mm projection. This test film is available through the S. M. P. E.

Silent 16-mm film has been made since 1925, sound being added in 1930. The year-to-year improvement in sound quality justified, economically, further development work. Thus, 16-mm sound quality has so improved that when the 35-mm and 16-mm versions are reproduced side by side through identical amplification equipment, most critical listeners cannot distinguish any difference in quality.

16-mm Film Picture Quality

Picture quality also has steadily improved. As finer grade release prints have been developed, greater definition has been achieved. Color 16-mm film preceded in many ways and served as a proving ground for the development and testing of new color processes now being used. There is no longer any valid reason why 16-mm film cannot be used for theatrical purposes, with a resultant saving in cost of handling, which in turn means more theatres and more projectionists employed.

Film damage is an important factor in 16-mm operation. This cannot be assayed by the relatively high amount of damage done by non-professional operating personnel, since 16-mm film has been generally supplied to educators and industrial concerns who demand that the projectors be able to stop and present a frame of film, with disastrous results to that particular frame in still-projection conditions; or that the projectors be able to reverse rapidly the direction of film travel, with equally disastrous results to the perforations. Automatic rewinds also contribute to film damage when handled by inexperienced personnel.

The factor for considering 16-mm film life, therefore, would be a life-test run of a loop of film through a projector test, which now has about reached equivalency with the 35-mm projector. We have consistently run film test loops in 35-mm projectors beyond 2500 circuits; in fact, the average would be closer to 3,000 circuits and, generally, specifications for 35-mm procurement state that it shall be possible to run a film loop for 800 circuits without excessive film damage. This is possible now on 16-mm equipment, and when handled by experienced projectionists, the same life span can be expected of it as now exists with 35-mm. We have not yet reached projection light intensity values that would seriously damage 16-mm film.

Screen Brightness Ratings

Heretofore 16-mm projectors have generally been Mazda-equipped and used as portables. No 16-mm screen brightness standards have been established similar to those set by the S. M. P. E. of 10 plus 4 minus 1 foot-lamberts for 35-mm equipment. This poses a considerable problem to 16-mm producers, who have experienced great difficulty in timing release prints for satisfactory use what with the wide variations in screen illumination as a result of trying to achieve a maximum-size picture, and projector variations in light-transmission efficiency.

For purposes of professional ratings, however, we shall use the S. M. P. E. standard of screen brightness for 35-mm, and to further simplify the comparisons to follow, it is understood that they will be made with shutter stationary on an idealized basis of 60% screen reflectivity and 60% shutter transmission, no consideration being given to the variation in light output with respect to lens focal lengths. By this method we arrive at the factor of 28 foot-candles incident screen light as requisite for satisfactory projection. Presently the 16-mm industry is far from this standard of screen brightness, the result of the essential portable non-theatrical use of 16-mm units.

Mazda-equipped projectors currently vary widely in efficiency between the limits of [utilizing a 750-watt Mazda light source as standard] 90 to 200 lumens of screen light. It can thus be readily understood that Mazda projectors are essentially portable units for amateur and semi-professional use, with illumination stand-

ards far below that considered adequate for professional projection. Even assuming the most efficient of Mazda light projectors, a screen size at 28-foot candles is indicated as not in excess of 7.15 sq. ft., which would be a picture width of 3¼ ft. Notwithstanding this comparatively low level of illumination, very satisfactory performances have resulted to date in the fields where 16-mm equipment has been mainly utilized.

Arc and Other Light Sources

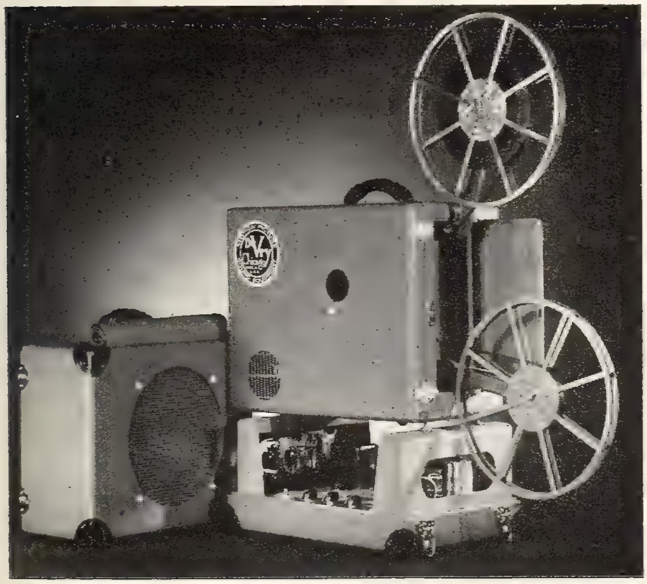
At present only one manufacturer is making an arc lamp for 16-mm projectors. This lamp is rated at 2200 lumens output. Dividing these 2200 lumens by our foot-candle factor of 28 results in 78.5 sq. ft. of screen area, which in turn limits the projection width of the picture to approximately 10.5 ft. This is the maximum illumination obtainable at this time, although a new type high-intensity carbon is in the offing having potentialities of doubling the present light output. This would mean 4400 lumens which, divided by the 28 factor, would mean a 157 sq. ft. screen image, or a picture 14.6 ft. wide. This is meeting the most critical of illumination standards. Actually, we have successfully projected pictures with a much lower illumination level and have had satisfactory showings on 15-ft. screens with the light source now available.

The ability of the film to withstand such heat has been established when infra-red filters are used, and there is no doubt but what future professional projection is a reality with this level of illumination. Also, at present arc carbons that will operate satisfactorily for 50 minutes are obtainable.

Two other light sources are distinct possibilities for high intensity 16-mm projection: the General Electric capillary type lamp, and the Western Union crater source. Neither of these sources has approached yet the intensity of the high-intensity 35-mm carbon arc, but they do offer distinct possibilities for competing with the *present* 16-mm arc lamp.

Of primary importance to the projectionist is the type of intermittent movement used, its potential life and its steadiness. 16-mm equipment generally has been constructed around the shuttle- or claw-type of movement rather than the familiar Geneva-type movement used in 35-mm projectors. The major determinate in this action for 16-mm film has been the fact of the lower mass of film required to be moved, the requirement that the maximum period of rest be attained for film projection, and the comparative costs of manufacturing which favor the shuttle movement.

Present type portable 16-mm equipment.



Geneva vs. Shuttle Intermittent

In 16-mm projection, for the same picture size, the projected picture is appreciably higher in magnification than that in 35-mm projection, thus necessitating a higher degree of precision in all of the intermittent movements. This becomes very expensive in the case of sprocket movements, when contrasted with the economy of a shuttle movement, which is registry repetitive and where the registry inaccuracies occur in the same order for each picture frame, thus resulting in a considerable manufacturing advantage leaning toward the shuttle movement. In addition, it has become standard 16-mm practice to have a triple interruption of the picture during projection rather than the double one commonly used in 35-mm theatrical projectors. This immediately makes compulsory a 60° intermittent movement at least for a 50% transmission.

The Geneva movement, with which we are all familiar, is a 90° movement of inherent design limitations with respect to the preceding. This is due to the fact that the pin must strike the star slot at direct right angles in order to reduce impact to the minimum, thus effectively preventing any increase in the number of sectors to the star and increase in speed. In 16-mm a very common type of movement would be a 40° type which cannot be duplicated in the conventional Geneva movement, therefore 16-mm sprocket systems are generally of the "drunken-screw" type of movement somewhat similar to the Powers intermittent.

All of the preceding tends to establish the fact that a shuttle-type system is an accurate and easily-produced type of intermittent, and it is possible by its use to achieve the intermittent speeds requisite for maximum illumination conditions in projection. The shuttle-movement, however, utilizes a skip action—a double-skip movement—meaning that the shuttle would be in engagement with the film only once out of three up-and-down passages of the shuttle. This in itself is an inherent weakness of the shuttle movement as customarily used, since the wear on the shuttle, excluding film friction, is twice as great as if it were possible to have the shuttle moving with an accelerated speed but only at the rate of 24 times a second, the normal projection frame speed.

From the standpoint of the operating life of the two movements before service attention is required, the score is heavily on the side of the Geneva movement, since it is possible for them to operate for well over 1,000 hours without adjustment. The shuttle movements as now made do not last this long by a wide margin, therefore relatively frequent replacements have to be made of these wearing members. Then, too, the shuttle movement is not in engagement with the film during the complete progress through the projector, therefore film that is damaged has less chance of satisfactory projection in the shuttle than

(*Continued on page* 76)

1926—Twenty Years of Horn Progress—1946

By W. W. SIMONS
Altec Service Corporation

THE first backstage equipment of the original 1926 Vitaphone equipment consisted of anywhere from two to six large wooden horns, each equipped with a single loudspeaker, and called the upper and the lower horns. The upper horn was designated the 12A (Fig. 1); the lower horn was the 13A (Fig. 2). Not only were these horns enormous in size but they were also quite heavy. Picture, if you will, the 12-type horn which was 52″ high, 45″ deep and 45″ wide, and weighed about 200 pounds. Then add to that the huge 13-type unit which was 58″ high, 50″ deep, 62″ wide and weighed almost 300 pounds. With more than one of each of these on a job, one can well imagine how much size and weight there was to contend with.

In the very early days there was no such thing as a sound screen, thus making it necessary to hang horns in front of and above the top of the screen so as to permit even distribution of sound into the theatre and yet not have the horns too conspicuous. This involved in many cases rigging up extra stage lines with counterweights, and where such lines were not available it was necessary to provide other means of support, which was not always easy because of the weight involved. The lower horns were usually placed on the stage on each side of the screen and covered by black scrim. In a number of instances these lower horns were hidden in an unused orchestra pit.

Screens Complicated Horn Placements

Getting these horns up was one thing ; flaring them for proper distribution was something else. It sometimes took hours of listening and brute strength to juggle them around to secure satisfactory results. Placing the horns in such a position did not, of course, make for the best sound illusion, but there was no alternative.

The first sound screen, the "Transvox," made its appearance in mid-1927. It was made from a fairly loosely woven fabric sufficiently porous to permit sound to come through without too much attenuation. The use of this screen eased the problem of hanging these horn monstrosities. Where there were no tie lines available, the upper horns were supported in huge square towers made from angle iron with a platform on the bottom for supporting the lower horns. The whole structure was mounted on casters so that it could be rolled off stage if necessary. Placing the horns behind the screen instead of above and at the side made a vast improvement in the illusion of sound coming from the screen and also made a great improvement from the standpoint of distribution.

The bulkiness of these early horns presented another problem: it was not uncommon to find at the last moment that doors were not large enough to allow the horns to pass through, and in such cases the horns had to be taken apart at the joints, carried through the doors in section and reassembled. An additional problem was the smaller houses where the space between the rear wall and the screen did not permit placing the horns. In those cases it was necessary to build a "blister" in the wall to accommodate the horns.

The next improvement was the ERPI 17-type horn (Fig. 3) or the 16-type horns (Fig. 4). The 17-type, although larger in cubical size than the 12-type, nevertheless was much lighter in weight, and because of its effective horn length took the place of both the 12- and 13-type horns in handling a wide frequency band. The 16-type horn was the answer to the problem of stage depth since, as can be seen, it was quite shallow, being only 25″ deep. The flare of the horn mouth, however, was such as to provide a wide distribution angle.

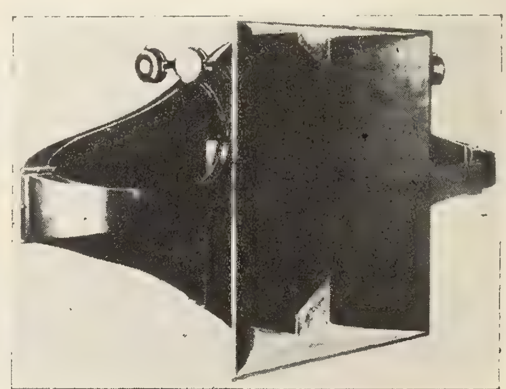
Due to its physical construction, it was possible in many cases to fasten the 16-type horn solidly to the screen frame; and in those theatres having stage presentations it was possible to fly the horn with the screen. But even this horn had its drawbacks: no one really seemed to know the reason why, but certain ones had a tendency to rattle at a particular frequency. The cure in many cases, if it was due to a loose joint, was (believe it or not) a good hard smack with a sledge-hammer. Later on, some energetic manufacturer developed a thick tar-like

FIGURE 1

FIGURE 2

FIGURE 3

FIGURE 4



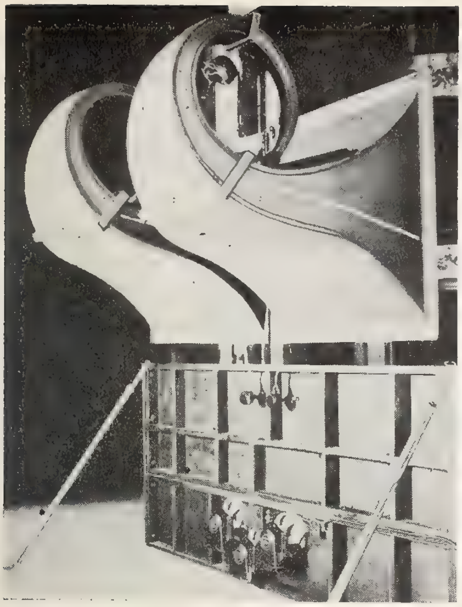


FIGURE 5

FIGURE 6

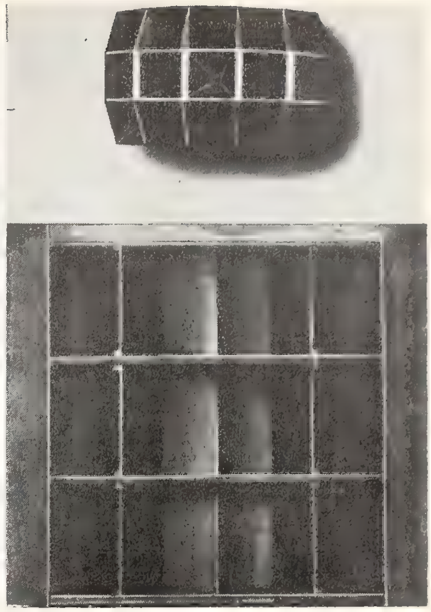


FIGURE 7

substance which when spread over these horns eliminated those troublesome rattles.

While sound reproduction from any one of this group of horns was considered satisfactory, the industry was not content to stand still. In 1933 ERPI introduced "Wide Range" in order to expand the frequency range. As shown in Fig. 5, there was added to the already existing horns a baffle on which was mounted from two to four low-frequency units, commonly known as "woofers," and one or two high-frequency units, commonly known as "tweeters." A three-way dividing network was included to provide for the proper distribution of power into each of the three branches of the horn circuit. Reproduction from this new speaker equipment was quite a noticeable improvement over the previous horn set-up.

'Wide Range' System a Major Advance

With the installation of Wide Range the fun really began. The addition of the "woofers" and "tweeters" to the existing horns, which had become the mid-frequency section of the system, brought on new difficulties. Heavy drapes had to be placed in positions in and around the Wide-Range horn equipment, some of them to overcome back stage "woomp," others to eliminate "interference" patterns between the mid-frequency and the low-frequency speakers. The "tweeters" also were a touchy problem, and were so critical as regards "phasing" that a matter of an inch one way or the other in their position with respect to the screen was the difference between good and poor quality of sound. During the interim many theories were tried out with respect to placement of the mid-frequency horns, such as turning them upside down, and rotating them 90° from their normal hanging position; and there were champions for each type of set up. However, as time went on, a definite installation technique was worked out which aided materially in setting up and testing for final results.

The year 1936 was an eventful one as far as new developments were concerned. At that time ERPI unveiled its "Mirrophonic" equipment. All of the sound equipment, including the amplifiers, sound heads and speaker equipment, had been redesigned and represented a distinct advance from the previous equipment.

The Mirrophonic backstage speaker equipment shown in Fig. 6 was noticeably different from previous such equipment for two reasons: first, because of the introduction of the multicellular horn; second, because of the new design of baffle which had changed from a flat type to a bin type. The area of distribution of sound from one multicellular horn was equivalent to that from two of the previous type horns. The reproduction from the low-frequency baffle was greatly improved and the problems of phasing between three sets of speakers was eliminated, since the multicellular horns with their associated speaker units, and the low-frequency baffle with its units, now represented a two-way speaker system with its associated two-way network. In order to handle the power from the amplifiers and also to properly distribute the sound in the theatre, there were several models of the Mirrophonic speaker system. Needless to say, the overall improvement in sound reproduction and distribution was very noticeable, even to the uninitiated.

Altec Lansing Horn Developments

About five years later Altec Lansing Corp. a subsidiary of Altec Service Corp., brought out three models of a theatre-type speaker system which were coded for size, namely, the 18-W5, 30-W5 and the 75-W5. Fig. 7 shows the model 75-W5 system designed for larger theatres. These horn systems were somewhat similar to the Mirrophonic systems in that they employed the multicellular horn and bin-type baffle. However, there were further improvements in the design and construction of both the multicellular horns and low-frequency baffles, as well as in the speaker units themselves, all of which showed up in providing improved reproduction.

Let us digress for a moment and comment on speaker power supply. At the start the source of field supply for speakers was the good old storage battery. These were rigged in groups so that one set could be charged while

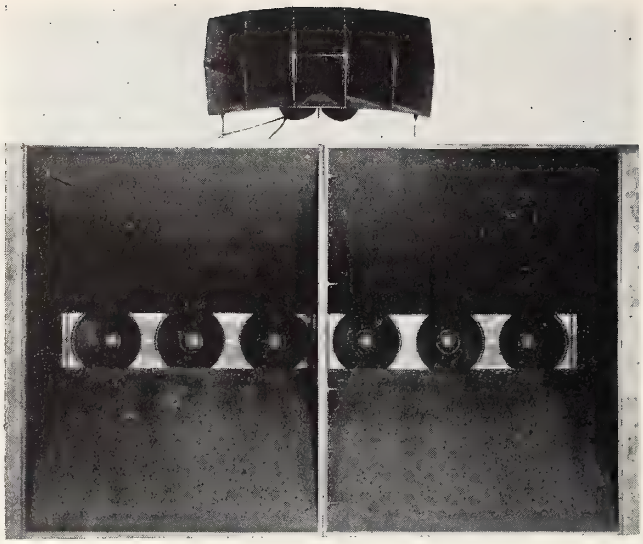


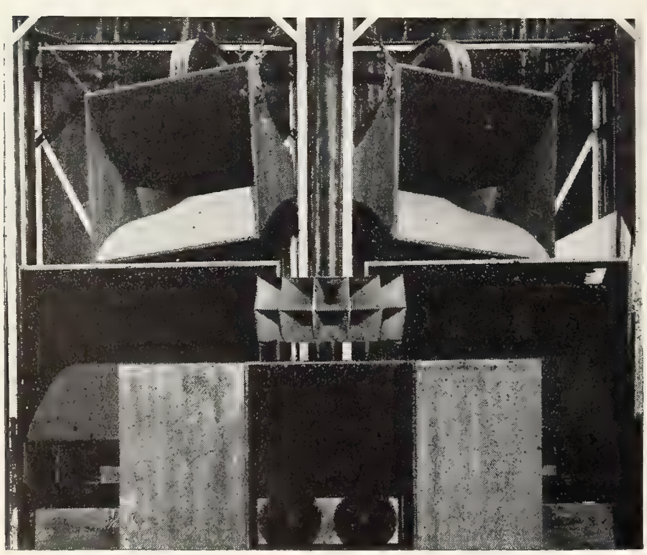
FIGURE 8

the other was in operation. All this required a certain amount of maintenance, which was sometimes overlooked, with the result that when it was time to open the show the horn batteries were discharged, following which there was a wild scramble to obtain rentals to get the show going. As time went on these batteries were gradually replaced, first by low-voltage motor generator sets, and later by rectifier-tube power units, many of which still are in use with the speaker systems installed during the era covered up to this point.

Altec Lansing 'Voice of the Theatre'

The Jubilee year of 1946 brings with it a new era of listening pleasure as provided by the Altec Lansing "Voice of the Theatre" speaker system (Fig. 8). The amazing results provided by this new system, of which there are many models, are not just due to chance. They are the result of years of research and new manufacturing technique, incorporated in the various components such as diaphragms, voice coils, pole pieces, as well as design changes in the multicellular horns, baffles and speaker units. Chief among these changes in the speaker units is the shift from electro-magnetic field, with all the bother of rectifier units and wiring, to the use of Alnico 5 permanent magnet. Use of this metal provides a compact self-energized speaker, which, with its highly concentrated energy, permits higher efficiency than ever before. This means greater acoustic power delivered with the same amplifier power. The low-frequency horns represent a distinct design change from anything heretofore developed: they are unique in design, rigid in construction and perfect in performance. An airtight, fully enclosed rear section eliminates back-stage reverberation and hangover, a condition which heretofore always gave trouble in varying degree.

FIGURE 9



An installation where an Altec Lansing "Voice of the Theatre" speaker system has replaced the earliest series of 12A and 13A horns supplemented with a wide range baffle is shown in Fig. 9. This picture shows more clearly than words could ever describe the changes that have been wrought by twenty years of progress in the development of loudspeaker equipment.

★ ★ ★

Projection Room Design Advances

By BEN SCHLANGER

Theatre Architect, New York City

A SIGNIFICANT illustration of the progress made in providing for motion picture projection equipment space may be had by looking back some 25 years when this space was referred to as the "picture booth." We now commonly find that this space has grown into being a suite of specially constructed rooms, namely, the projection room proper, the film rewind and storage room, power equipment room, and lavatory. Another significant illustration is had in noting the physical construction of the enclosure of the old "booth" and today's projection rooms. The old "booth" was virtually a cubicle made of sheet metal, asbestos board, or even wood, metal covered. Compare this with heavy steel framing, masonry and concrete now used for projection room construction.

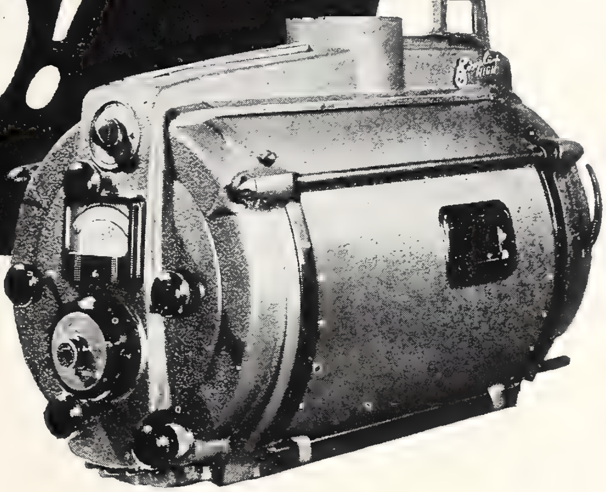
Not only is the construction now made to properly support the weights imposed on it, but it is also made adequately stiff to control as little as 1/500 inch vibration in the projection room floor to guard against any amount of jump in the projected screen image.

Not so long ago it was common practice for the "booth" to have a vertical ladder as the only means of ingress and egress. Compare this with the full-size doors, one from each end of the projection room, which lead to a regulation stairway now incorporated in most all recent theatre improvements. These doors swing out in the direction of emergency egress and are of fire-resistant construction, as is the rest of the projection enclosure. The importance of utmost safety for the audience and the projectionist is by now fully realized.

Another happy development recently is the use of a lift for bringing film to the projection room level. This

(*Continued on page* 72)

This is the lamp!



• This is the lamp that projectionists know so well for its perfect performance—the lamp that delivers the abundance of light so necessary to satisfactory projection.

Simplex HIGH

PROJECTION ARC LAMP

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"THERE'S A BRANCH NEAR YOU"

August 6, 1926
Warner Theatre
New York City

THE death-knell of the old silent motion picture in the theatre exhibition field was sounded just 20 years ago when on August 6, 1926, John Barrymore appeared in *Don Juan* at the Warner Theatre in New York City. Barrymore, the star, and others of the cast of *Don Juan* were inaudible, however, since this film offered only a "fully synchronized and recorded musical score." But on a surrounding program of short subjects opera and concert performers sang and played, the sound being played back from discs synchronized with the pictorial imagery.

Sponsoring this historical film exhibit were the Warner brothers—Jack L., Sam L., Albert W. and Harry M.—whose activity in the motion picture business goes back to 1906 when they opened their first theatre at New Castle, Penna. Subsequently the Warners became top-flight prodcuers of silent feature pictures, their steady progress toward their present eminence in the film world being marred only by the death of Sam Warner.

The equipment used for the first public exhibition of

WARNER BROS. PICTURES, INC.

in association with

THE VITAPHONE CORPORATION

Present

VITAPHONE

and

JOHN BARRYMORE *in "Don Juan"*

VITAPHONE PRELUDE

Hon. Will H. Hays
President of Motion Picture Producers and Distributors of America welcomes VITAPHONE.

The New York Philharmonic Orchestra
Henry Hadley conducting, Overture from "TANNHAUSER", Wagner.

Marion Talley
By arrangement with the Metropolitan Opera Company, Caro Nome from "RIGOLETTO", Verdi, or "Home Sweet Home."

Efrem Zimbalist and Harold Bauer
Variations from "KREUTZER SONATA", Beethoven.

Roy Smeck
in "HIS PASTIMES"

Anna Case
"LA FIESTA", supported by the Cansinos and Metropolitan Opera chorus. Accompanied by the Vitaphone Symphony Orchestra, Herman Heller conducting.

Mischa Elman
Josef Bonime, accompanist
"HUMORESQUE", Dvorak.

Giovanni Martinelli
By arrangement with the Metropolitan Opera Company.
Vesti la Giubba, from "I PAGLIACCI", Leoncavallo.
Accompanied by the NEW YORK PHILHARMONIC ORCHESTRA.

Incidental music to the above numbers played by members of the New York Philharmonic Orchestra, Herman Heller conducting.

Program Subject to Change Without Notice

Here is a reproduction of the fateful Vitaphone program that revolutionized the motion picture business 20 years ago this August 6.

This is how the well-housed sound-film cameraman looked in 1927, when camera noise was a terrific production problem.

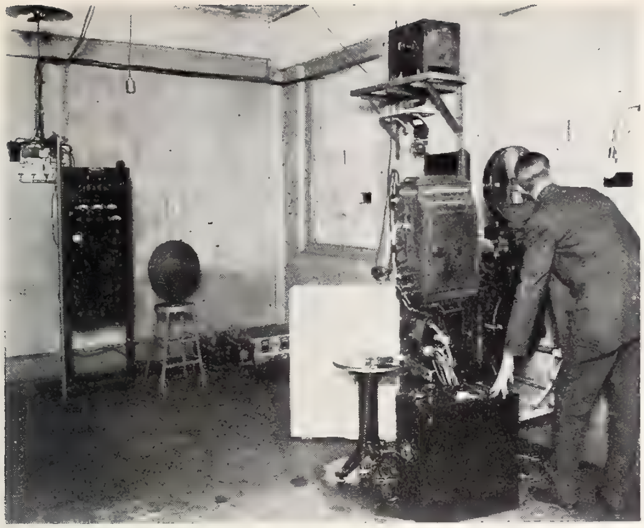
"talking pictures" on that sultry August night twenty years ago was the famed "Vitaphone" unit which, when favored by good reproducing fortune, effectively synchronized sound and vision and offered a realistic audible film presentation. Vitaphone was the outcome of extensive development work by Western Electric Co. and the Bell Telephone Laboratories.

To say that *Don Juan* revolutionized the motion picture business is putting it mildly: history was made that August night; and the motion picture industry, too, was made (and very nearly unmade) at a time when slumping box-office receipts threatened the movies' theretofore vise-like grip on the entertainment preference of the theatre-going public. Oddly enough, it wasn't until 1928, two years after *Don Juan*, that the first "all-talking picture" (as they were then termed) was publicly exhibited, also by the Warners; although six months after Don Juan, William Fox and Theodore Case introduced the Movietone Newsreel, a sound-on-film process.

The scientific development of sound pictures traces its ancestry to the inventions of Thomas A. Edison and of Dr. Lee De Forest, the latter by means of his development of the so-called "audion" (three-element) amplifying tube. In 1887 Edison wrote:

"The idea occurred to me that it was possible to devise an instrument which should do for the eye what the phonograph did for the ear, and that by a combination of the two all motion and sound could be recorded and reproduced simultaneously." Two years later, on October 6, 1889, Edison gave the first demonstration of a small motion picture mechanically synchronized with a phonograph record. By 1913 Edison has made nearly twenty brief motion picture subjects for the "Kinetophone," as the Edison device was known, and these were shown in a number of theatres in various parts of the country.

De Forest developed a sound-on-film method of synchronizing sound with motion pictures which he called "Phonofilm." Demonstrations of Phonofilm were given in De Forest's Highbridge, New York, laboratory in



The super-super product of the electronic age 20 years ago; an experimental setup for Vitaphone complete with turntable, motor control box, monitor horn, amplifier and modern (?) carbon arc lamp.

1921; and in 1923 and 1924 he gave demonstrations of Phonofilm in the Rivoli and Rialto Theatres, in New York City, and in other theatres throughout the Eastern U. S.

Contributing substantially to the development of sound reproduction from both disc and film, in addition to those previously named, were the Victor Talking Machine Co., which cut the original Vitaphone dics and established the pioneer technique therefor; the original Columbia Phonograph Co., Eastman Kodak Co. and the Du Pont Co., the latter two developing the means for sound-on-film recording.

This necessarily brief and sketchy resume of the beginnings of sound films would err grievously in omitting the name of one man who, it cannot successfully be disputed, was the father of sound-on-film recording *and* reproduction. This man was Eugene Lauste, who in 1906 was granted a British patent on the sound-film process not as a theory but on the basis of an actual demonstration! Lauste's original patent has had down through the years the greatest number of reprints of any patent ever filed in the British patent office.

Strange it is that nowhere in the ranks of those now taking bows for the introduction and subsequent development of the sound-picture art can there be found room for the bent figure of Eugene A. Lauste, the first man to successfully record and reproduce sound-film.—J. J. F.

Projectionist—Dealer Teamwork

By RAY G. COLVIN
President, Theatre Equipment Dealers Protective Association

WHEN we speak of an anniversary in terms of 1st, 10th, or even 25th, we do not think too much about it. However, the beginning of a second 50-year span of service for any organization is a horse of another color, and I would say a horse that comes from good stock and has been given the best of care. We look twice, we think twice, and we say to ourselves that there must be a lot of good in an organization that gives 50 years of service to an industry and still is going strong. So, on behalf of the Theatre Equipment Dealers Protective Association, which has looked at you twice, thought about you twice, I want to extend our congratulations to you I.A. men on the progress made by your organization as it embarks on its second 50-year span of service to show business.

In 1944, when the I.A. convened in St. Louis, I had the pleasure of seeing many of you boys, and from the questions asked by you I feel that you might be interested in the workings of our dealers' organization, which is so closely related to your work. TEDPA is composed of 56 dealers in theatre equipment and supplies from all corners of the United States and Canada, its members selling everything from the front door of a theatre to the back door except the picture itself. Our main object is to secure and maintain closer relationship between the manufacturer and the consumer.

During the war years practically all types of equipment and supplies were issued to the dealer on priority ratings; thus it became necessary to give our dealer members instant information on changes of government rulings, procurements possibilities, price changes, etc. This was done by being in daily contact with the War Production Board. While many theatres were not able to obtain exactly what was wanted immediately, our service between manufacturer, dealer, government agencies and consumer was such that not one theatre was forced to close for lack of equipment or service. I am proud, indeed, of a record of this kind through the war years.

Projectionist-Dealer Team Advantages

To you projectionists who struggled through these years with equipment that required almost constant attention in some cases, and did so with a minimum of grumbling, I want to say "Thank you" on behalf of the dealers. It required teamwork to keep the theatres of this country open, and you men were definitely a part of this team. This team will continue to work together, and this close relationship between the projectionist and the dealer will do much to bring continued satisfactory results in projection to the millions who depend on us for entertainment.

The closer the relationship between the various units of show business, the easier it will be to justify that entertainment slogan of "Bigger and Better." Drop in on your favorite supply dealer, renew old acquaintances. He may have something new to show you, and in turn you might give him a new idea.

The 1946 convention of TEDPA will be held in Chicago September 30 through October 3, in conjunction with the manufacturers. A gigantic trade show is planned and you are invited to look this over. It will be a very good opportunity for you to get first-hand knowledge of all the new ideas that will be introduced in the theatre equipment field in the months to come.

★ ★ ★

Motiograph: The Early Years (1896-1924)

By ALVAH C. ROEBUCK
Founder of Motiograph

FOR some reason that I am not entirely able to comprehend, the average person seems to compare me with some sort of legendary figure of the past—a living connection, as it were, with the great by-gone era when many of our giant commercial enterprises were founded. This amuses me. While not active in any business at the present time, I am certainly very active mentally in my interest in the business world of 1946, and particularly in the motion picture industry. On my occasional visits to the Motiograph plant I still find myself greeted by former employees who worked with me in an enterprise to which I devoted a large part of my business life.

Possessed of a natural mechanical instinct, I first turned my attention to watch repairing, perhaps because of a watch which I inherited from my father and which had no defect other than it did not run because it needed cleaning and oiling. Mainly with the aid of home-made tools, I succeeded in fixing my watch, and with the knowledge thus acquired repaired the watches of many of my schoolmates and neighbors. My price for fixing watches was 25 cents. This early mechanical interest was prophetic of my later association with the motion picture business.

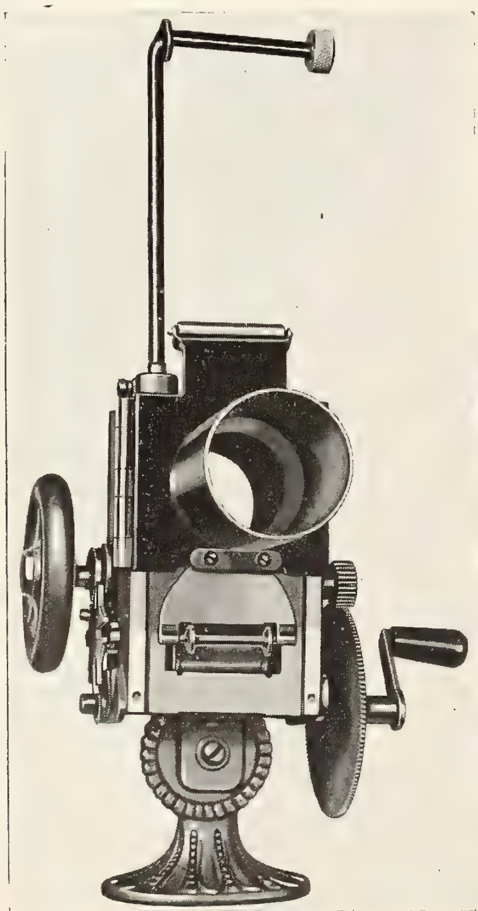
In 1895 there was little in the way of entertainment for residents of smaller cities and towns, other than amateur theatricals and an occasional circus. I conceived the idea of offering for sale an "entertainment outfit," by means of which the purchaser might liven up church social activities and at the same time earn some extra money for himself and for the church. As the talking machine was then a novelty, our first outfit featured a phonograph, records and all necessary accessory equipment.

'Magic Lantern' Launches Motiograph in 1896

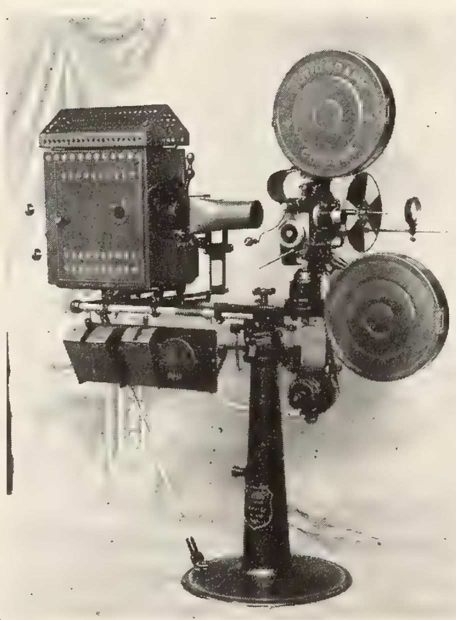
Motiograph really began its existence in 1896, when we switched to a magic lantern and thus entered the projection field. The complete outfit consisted of a magic lantern, a choice of several sets of from 52 to 80 slides, a supply of advertising posters and admission tickets, a book of instructions, etc. Perhaps at this point the reader may indulge in a tolerant smile at the simpler amusements of the preceding generation, but let me say that the magic lantern idea was a huge success. Orders poured in from all parts of the country, and within a very short time the sale of entertainment outfits constituted an appreciable portion of our business.

It was largely that I might devote all of my time to Motiograph, then known as the Enterprise Optical Mfg. Co.,

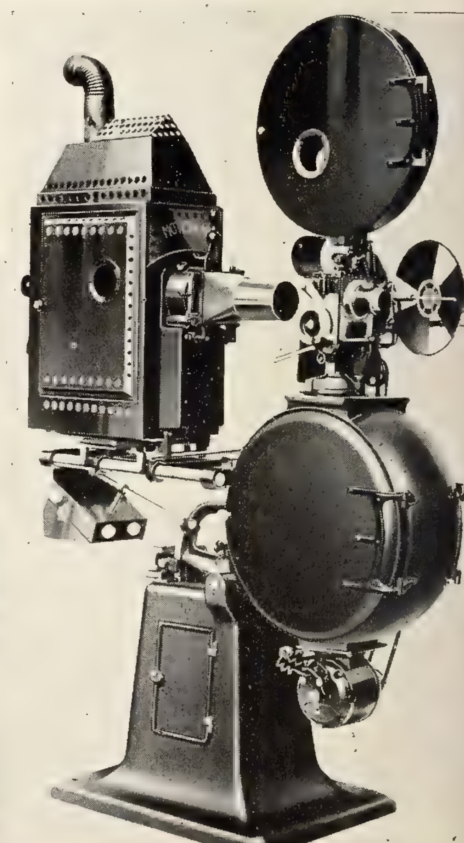
THE FIRST 20-YEAR SPAN IN THE DEVELOPMENT OF MOTIOGRAPH



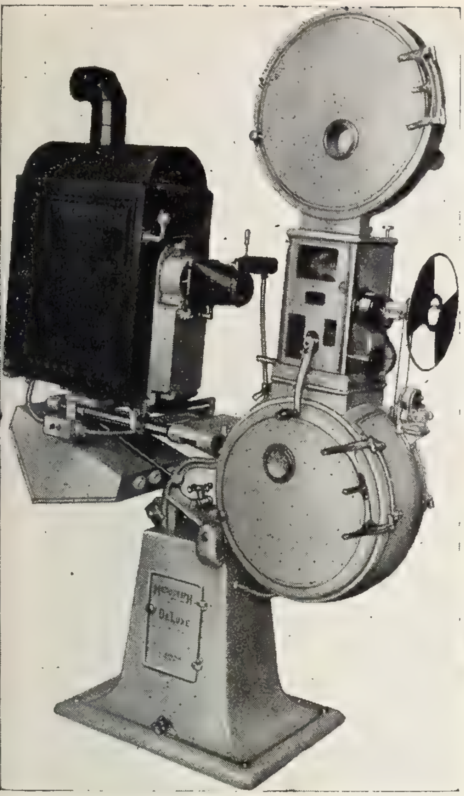
Left: The Optigraph, one of the first practical motion picture projectors.

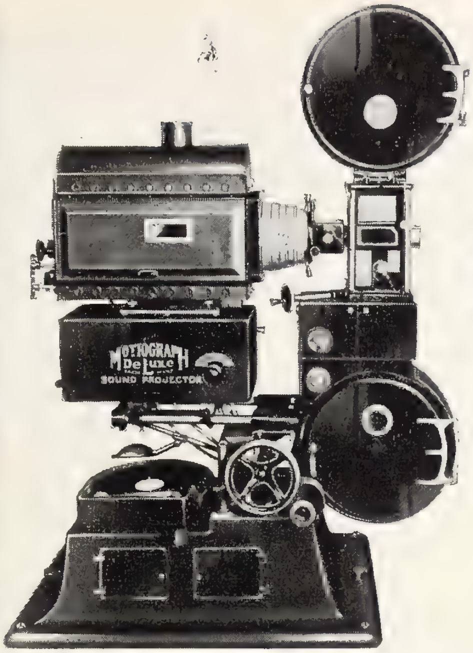


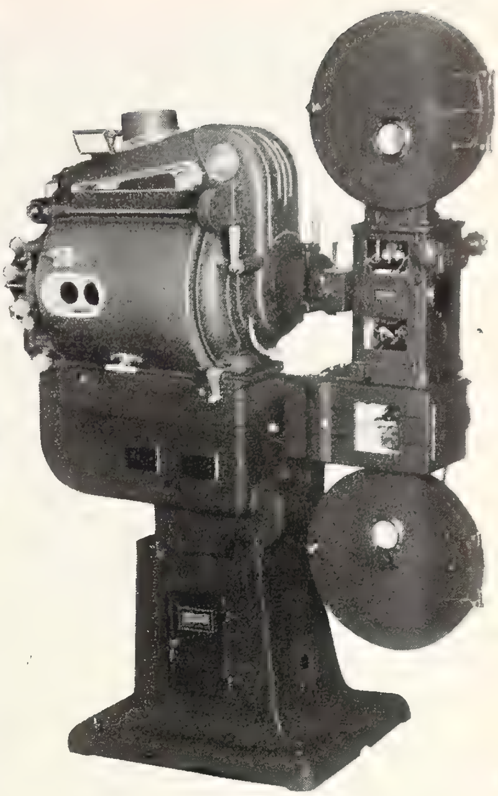
Below: The Model IA which was introduced in 1908.



Right: 1916 saw the Model E score notable advances.







THREE MORE RECENT MOTIOGRAPHS
Left: Model F; above; Model H; right: the current Model K projector

that about 1897 I disposed of my interests in Sears, Roebuck & Co. Two years later, with a feeling of sorrow and in opposition to the wishes of Mr. Sears, I resigned from the company which we had founded.

The year 1898 marked an important era in not only the history of the company but of the motion picture industry generally, for in that year we produced the Optigraph. I sincerely believe, after considerable research on the subject, that this was the first *practical* motion picture projector. The Optigraph was a combination motion picture projector and magic lantern. You may form an idea of what it looked like from the accompanying illustration as well as my description of it. In order to achieve a combination machine, I had conceived the idea of a hinge which permitted one to swing open the lens portion of the projector and insert the film. It was hand-operated by means of a crank, while lighting was obtained by means of an incandescent lighting outfit employing gasoline. Many people may view it today with something akin to mirth, but at the time it proved itself to be a very serviceable little machine.

The 1908 Model 1A Motiograph

The ensuing decade constituted what might be termed a period of development. A number of improvements were made in the mechanism, including a very simple and efficient framing device, while the addition of a film takeup reel provided an element of safety and greater protection for the film. All in all, the little machine was beginning to evolve along the lines of the modern projector.

Our real entry into the field of the motion picture theatre began in 1908 when we produced the Model 1A Motiograph. In many respects it may be considered as the first high-grade modern projector, and I still think it a splendid piece of equipment. It was well engineered, and I understand that in recent experimental tests it maintained a surprisingly good performance. The principal points of the Model 1A may be reviewed briefly. It was provided with an improved shutter and had a very accurate Geneva movement. The projector was mounted on a strong, cast-iron pedestal, with a broad circular base instead of small tubular legs. The crank and stereopticon arrangement of the earlier models was retained.

The Model 1A was the only motion picture machine of distinctive design that had then been originated and constructed since the advent of the motion picture theatre. A series of changes were incorporated in new models during the succeeding years, including the first double shutter, which appeared in the Model D. It was our constant desire to maintain our margin of superiority by means of improvements and new inventions. Nearly one hundred successful patents were issued to me.

The next really important epoch in Motiograph history was the advent of Model E in 1916. Let me allude to a few of the principal developments. The motor was still operated by means of belts, but it was placed beneath the lower magazine and was provided with a speed control, so that speed variation became absolutely mechanical and positive. A new type of condenser mount was designed to permit the removal of the lenses when hot without touching with the fingers. Both the stand and the magazines embodied revolutionary improvements in design and were superior to anything else in the field. It should be noted that the shutter, the crank and the stereopticon arrangement still form integral features of that day's projector.

The 1921 Model F a Great Advance

It was in 1921 that we introduced the Model F Motiograph. This projector soon established itself as a superlative mechanism. Among the many improvements presented in this model, I recall chiefly the following: for

(*Continued on page* 67)


DU PONT
PANCHROMATIC • NON-HALATION
SUPERIOR 3 NEGATIVE
DU PONT
PANCHROMATIC • NON-HALATION
SUPERIOR 2 NEGATIVE
NITRATE MOTION PICTURE FILM

Why Coated Lenses?

By DR. A. F. TURNER
Bausch & Lomb Optical Company

SEVEN years ago "coated" lenses were offered to the profession. They gained immediate and widespread acceptance, and have grown in popularity ever since. Today in thousands of projection rooms discerning projectionists rely upon these lenses to put the "extra punch in the picture" due to greater screen brilliance and contrast in both black-and-white and color productions. The manufacture of these lenses was curtailed greatly by the necessities of war production, but commercial work has now resumed and coated lenses for motion picture projection again are available.

These early coated lenses were accepted largely on faith and upon the reputation of the manufacturer, with little reference to the basic facts about coated lenses and how the coating affects the optical performance. Herein are summarized a few of these facts and the reason why coated lenses are now considered standard equipment.

The improvement which coated lenses have on screen image quality can be readily inferred by a casual examination of such a lens, especially if it be compared with an untreated one. In the first place, the "insides" of the barrel of the filmed lens are more easily seen than of the untreated one. The explanation is that the glare of light reflected from the unfilmed lenses obscures one's view into the lens barrel. It is the same difficulty that one has in looking into a darkened room through a window on which the sun is shining. The coating reduces the glare to a point where one can look through it, as it were. Sometimes, in fact, with the illumination just right, it seems as if the lenses were missing.

Secondly, if a piece of paper be held behind the two lenses, it appears considerably brighter when viewed through the filmed one. Evidently more light is passing through the coated surfaces than through the uncoated. The accompanying illustration is a photograph of a pair of projection lenses—one coated, the other not.

Sharp Reduction of Glare

The reduction of the glare from the lens surfaces and the increase in transmission brought about by the surface treatment go hand in hand. The one is the result of the other. Most of the light which before coating is reflected as glare is reclaimed by the coating process and allowed to pass through the lens as useful image-forming light. Consequently, a treated lens will furnish a brighter screen image by 25% or more.

If there be any doubt on this point, just make an experiment sometime of measuring your screen brightness with an illumination meter, first with an ordinary lens, then with a coated lens of the same type. The large difference between the two will make it apparent why it is unsatisfactory to attempt to use a coated lens in one projector and an uncoated in the second. The sudden jump in screen brightness upon changing over between reels is as disconcerting to the audience as to the projectionist. If the latter is having his first experience with coated optics, he may be tempted to think that the current in the projector with the untreated lens has dropped or that the carbons are out of adjustment.

The other improvement in image quality obtained with coated optics has to do with the effects of eliminating flare. In this connection the results on the screen are of a more subtle nature than the very apparent brightness increase aforementioned. They are, however, as definite to the exacting projectionist as the improvement he obtains in replacing a single lens by a more perfectly corrected one which will give him a sharp focus from the center out to the very corners of the screen.

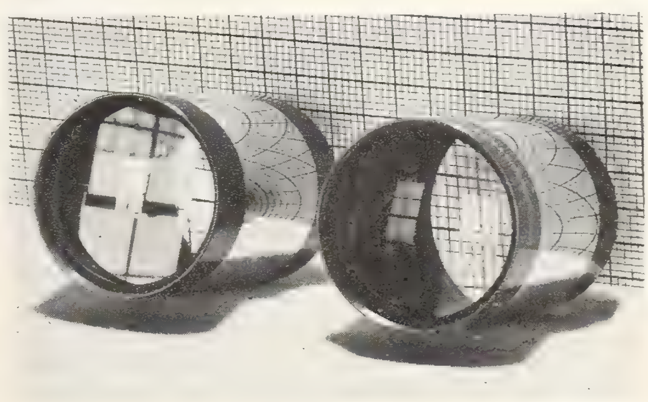
Prevents Loss of Light

The coated lens goes a step farther, not by increasing sharpness of focus, but by enhancing the contrast. Blacks become blacker—highlights become crisper—and colors take on their full richness and brilliance, not being diluted with scattered light. This is all due to the reduction of flare in the lens, brought about by the coating process.

As the projectionist commonly uses the term "flare," it is a haze covering the screen and injuring contrast in the same way as the footlights would were they left on during a performance. This flare is closely related to the aforementioned glare, which made it difficult to see the inside of the barrel of the ordinary uncoated lens. Each of the glass surfaces in the assembly reflects a small portion of the light falling on it. Some of this reflected light may again be reflected at another surface, and so on. The net result is that a fraction of the light initially falling on the lens becomes a sort of errant light, either wandering toward the screen or toward the film strip—in both cases useless, as far as image formation goes. In fact, it is worse than useless, because it clogs the true image with an out-of-focus haze.

Although the amount of light lost by reflection from a single surface seems insignificant — possibly 5% — nevertheless in every well-corrected lens with its several elements, it adds up to a rather large value. Thus, in a four-element lens, the eight surfaces subtract 35% of the total light passing through them, and of this 35% a considerable portion may ultimately reach the screen to the detriment of contrast or of color saturation. Coating the same lens greatly decreases the reflection loss from each

Comparsion of uncoated (left) and coated projection lenses, showing marked reduction in reflections and freedom from glare in the coated lens.



surface. This not only allows correspondingly more light to be transmitted directly to the screen, but at the same time practically eliminates the errant multiply-reflected light which gives rise to the flare so damaging to contrast.

Projection lens flare is often more difficult to evaluate than camera lens flare. In a camera lens, flare can take the form of sharply-defined ghosts, the existence of which, when they appear, is certainly definite. The existence of haze, on the other hand, may be overlooked except to an experienced eye. If a direct comparison be made, however, between the images from an uncoated and a coated lens, such a comparison leaves no room for doubt about the superiority of the coated lens.

Nature of the Coatings

The coatings to which the lenses owe their augmented brilliance and freedom from flare are exceedingly thin transparent films with thicknesses of about four millionths of an inch. Their behavior is easily explained in terms of the interference of light, which is also the underlying cause of the colors of soap bubbles. The lens coatings also appear colored in reflected light. Although these colors may appear to be very pronounced or saturated, practically no perceptible tint is imparted to light transmitted through the lens. It would lead too far to go deeply into the theory of these effects here. It must suffice to say that the lens coatings are practically equal in effectiveness for all wave-lengths or colors of the spectrum. There need be no hesitancy in using coated lenses for color movies. On the contrary, it was with colors that they first gained popularity.

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I.A. Servicemen in 136 Locals Constitute the Unique A. E. E.

By RALPH KAUTZKY

President, Associated Electronic Engineers

TWENTY years ago show business suddenly and completely changed: sound pictures caught the public fancy and, almost overnight, the scramble for equipment was on and many new faces appeared within industry ranks. In one industry sector men from various walks of life, but mostly from the telephone and radio fields, served as installation men and, later, as sound servicemen. As time went on these men in general proved to be hard-working individuals who did their job and minded their own business; they were competent, reliable and sociable.

While you I.A. men were observing them, they were observing you and your Alliance. Having learned the value of organization, they were pleased and grateful when in 1938 you brought them into your Alliance as members of various projectionist locals. However, most of these men are not projectionists; they are soundmen and do a specialized job, as is recognized by the I.A. which contracts to supply their services "*for the purpose of sound service and sound installation work exclusively, in the motion picture and theatrical field, inclusive of all motion picture and theatrical television work.*"

Despite all the benefits derived from I.A. membership, the nature of our work and our locations are such that we felt the need for a medium whereby we could exchange views, talk shop, blow off excess steam occasionally, and obtain the opinions of our fellows on matters of *common interest.* Since a soundman's work and working conditions vary with locale, it was also deemed expedient that a study be made of the national picture with a view to recommending to the I.A. improvement in our status.

Primary Objectives of the A.E.E.

A society of soundmen seemed to be a satisfactory medium for best serving these interests; accordingly, such a cooperative society was formed in New York City in mid-1943. This society became known as Associated Electronic Engineers. Summarizing the reasons for this Society:

Soundmen realized the limits of their individual efforts and knew that more could be accomplished collectively. The average soundman is pretty much on his own, having no one with whom to talk shop, technically or from a business viewpoint. He usually works alone and has a tendency, partly due to the nature of his work and to training, to be a "prima donna" or "lone wolf"—this despite the fact that his very existence depends upon group effort. Additionally, there was a tendency for the competitive efforts of our employers to engulf us to the extent that frequently soundmen of competing companies shunned each other—even though they are brothers under the skin.

Still another and compelling reason, to speak frankly, was the lack of interest in the affairs of soundmen displayed by the various locals. True, from the latter's point of view, we were a minority group with highly specialized problems of little interest to the majority of other members. Moreover, the locals were conscious of the fact that they did not control directly their soundmen members, such direction residing with the I.A.

Finally, it seemed expedient, too, that some one representative group of soundmen obtain the facts of our business and be in a position to render intelligent and factual advisory service, if and when required, and to act as a liaison between soundmen generally and the General Office of the I.A. Such, then, were the reasons for forming Associated Electronic Engineers.

A.E.E. wes designed to promote the knowledge of electronics and its associated fields as they pertain to the theatre, and to engage in any lawful activity tending to improve the status of its members. Also, it was intended to promote the goodwill and cooperation among *soundmen themselves,* and between soundmen and those with whom they work.

65% of All Soundmen in 136 Locals

The organization is based upon unity and cooperation. The cost of membership is nominal, since all receipts are used *exclusively* for stationery, printing, postage, official Society functions and a limited amount of advertising. No member receives any salary or other compensation from the Society for efforts in its behalf. The work of its officers and committeemen is also rendered at no cost. Every

(*Continued on page* 69)

MOTIOGRAPH: THE EARLY YEARS (1926-46)

(*Continued from page 61*)

the first time the mechanism was enclosed, which gave a decidedly improved appearance to the entire projector. There was likewise a better lens arrangment, removable bearings, and a variable-speed gripping disc. While retaining the front-type of shutter, it was now a two-blade shutter, and with a timing device so that it could be timed while the machine was running.

The projector was provided with a generator with a capacity of 6 volts for the pilot lamp. Much work had been devoted to the base, which had been improved for tilting. The magazines elicited much favorable comment, being provided with peepholes. One notes that the projector still is equipped with a crank, although the stereopticon has been enclosed.

The Model F Motiograph was the last produced during my tenure of ownership. After so many years in the manufacture of motion picture projectors, the increasing pressure of other interests induced me to part with Motiograph. After nearly twenty-five years, however, one cannot entirely lose a love for the motion picture industry. I follow the progress in design of the postwar Motiograph with considerable interest, and cannot help but reflect on the tremendous progress which has marked projector design and construction during the present century. This new postwar model, I may say, with its startling developments in all respects, should prove a worthy successor to the famous Motiograph models of the past.

Motiograph: The Later Years

By RAYMOND SHERMAN
Partner, Motiograph

THE modern era of Motiograph dates back to 1931 when the Model H sound-film projector was introduced. Among the principal modifications in this model were minor changes in the mechanism and a cylindrical type, double-blade rear shutter, which improved the light on the screen and eliminated excess heat on the film. There was a pinion framer, operated by means of a rather large wheel placed behind the lower magazine; while the installation of sound had made necessary some important modifications in the construction of the base. The projector was provided with a low-intensity Motiograph arc lamp, with switch and rheostat in the box below.

In 1935 we also had a new projector, which was really

an improved model of the old Model H. This model enabled us to secure greater adaptability to sound systems of the manufacturer.

By 1936 we had both a new name and a new projector. On March 1, 1936, the company name was changed from Enterprise Optical Mfg. Co. to Motiograph. The new projector was the well-known Model K, the main features of which are so well known as to require only brief reference. Motiograph changed from single to double bearings, installed a one-piece shutter, and made various improvements in the mechanism. The projector was provided with an improved base and a faster framing device, located in front of the mechanism. The start of the present line of Motiograph sound systems was made in 1938, through agreement with ERPI, a Western Electric Co. subsidiary, which permitted the full use of the many W. E. patents on sound-reproducing systems.

Pearl Harbor interrupted plans of introducing a new Motiograph model. The intervening period has given our engineering staff a breathing respite, and enabled us to incorporate many of the startling technical advances which have been brought forth by the war. As a result, the new postwar Motiograph, when released in late 1946, will represent a great improvement over that planned for 1942.

When the new mechanism appears, it will not be entirely the product of Motiograph's engineers. Many of the developments and improvements in performance and operation will be a result of suggestions made by projectionists, while the organization of Motiograph supply dealers have made many substantial contributions.

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I. A. SERVICEMEN CONSTITUTE THE A. E. E.

(Continued from page 64)

individual works for the interests of all members.

That the Society satisfied a pressing need is evidenced by its constantly growing membership: the more than 65% of all theatre soundmen who are members belong to 136 different I.A. local unions; also, several are members "at large." All members of A.E.E. are soundmen. Our activities, including publication of a journal, "The Thousand-Cycle Loop," and monthly meetings in New York City, may be summed up briefly as being dedicated to our own welfare and that of our brother members, the projectionists.

Many soundmen feel keenly the fact that, due to being scattered among widely separated I.A. locals, they have no direct voice in matters that concern them *as soundmen*—a situation that would undoubtedly inspire similar feeling among studio workers, stagehands, projectionists or any other group within the I.A. The latter negotiates our contracts, but no provision has been made for representation of soundmen *as such*. Thus, while we are members of a family it seems that we are destined perpetually to be children, never to grow up.

The interest and sympathetic understanding of all crafts within the I.A. is solicited to the end that there will be worked out a solution to this problem which will redound to the benefit of the soundmen in particular and the Alliance in general. Meanwhile, the soundmen will continue to exert their best efforts to advance the interests of the art and the craft.

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EVOLUTION OF THE PROJECTION ARC

(*Continued from page 27*)

less than the maximum previously allowable. These carbons were known as "Victory" carbons. A very substantial saving of copper was effected by their adoption and by the cooperation of theatres in saving the copper drippings from the lamphouses and turning them in to authorized dealers. This war emergency has now passed and carbons of the original type will again be available.

16-mm Carbon Arc Projection

Many occasions arise for the projection of 16-mm film in school auditoriums, before industrial groups, and for other non-theatrical uses where an audience of a few hundred to several hundred people may be present. This requires a screen of considerably greater size than that commonly used for 16-mm projection and a correspondingly greater volume of screen light. Special high-intensity carbons and projection lamps have been developed for this purpose. A variety of projection lenses are available, those most commonly used being a lens of 3-inch focal length and $f/2.0$ speed, and a 2-inch lens of $f/1.6$ speed.

TABLE B. CRATER BRILLIANCY OF CARBON PROJECTION ARCS

	Candles/mm²
Positive crater of d. c. low-intensity carbon arc	155-175
Crater of a.c. high-intensity carbon arc at 80 amperes	360
Positive crater of d. c. high-intensity carbon arc with non-rotating positive at 70 amperes	700
Positive crater of d. c. high-intensity carbon arc with rotating positive—Regular trim at 125 and 150 amperes	550-875
Positive crater of d. c. super high-intensity carbon arc in present use at 170 amperes	940
Positive crater of new d. c. super high-intensity carbon arc at 290 amperes	1400
Positive crater of experimental d. c. super high-intensity carbon arc	2000

Inasmuch as 16-mm color film of the non-theatrical type is usually processed for projection with incandescent light, special high-intensity carbons have been developed which produce a light with color composition adapted to this type of film. These carbons are sold under the trademark "Pearlex." The 6-mm positive and 5.5-mm negative are designed for operation at 30 amperes with 28 volts across the arc. When operated at these conditions, with an $f/1.6$ projection lens, but without shutter, film or heat filter, this arc projects 2300 lumens onto the screen.

TABLE C. COMPARISON OF COLOR COMPOSITION OF LIGHT

	Violet & Blue	Green & Yellow	Orange & Red
D. C. low-intensity carbon arc	18%	32%	50%
High-intensity carbon arc	34%	35%	31%

Outlook for Future Progress

The high-intensity carbon arc and the attendant optical system, lamp and projector system hold promise of providing further increase in illumination on screens of large area. Carbons of greater light output than those described have been produced but have not as yet been applied to theatre projection inasmuch as they require special air-cooled or water-cooled contact blocks and higher feed rates than projection lamps now in use are designed to provide; for example: a new 13.6-mm super high-intensity positive carbon operating at 290 amperes and 80 volts with a new 5/8" copper-coated cored negative carbon has a crater brilliancy of 1400 candles per sq. mm. This arc at 80% side-to-center distribution with $f/2.2$ condenser system, $f/2.0$ treated projection lens and heat filter, but

without shutter or film, provides 24,000 screen lumens. Without heat filter the screen light is 30,000 lumens.

Further improvement of the carbon arc, as applied to projection, can reasonably be expected. It is impracticable to attempt a prediction of the brilliancy which may at some time become available from carbon arc light sources. It suffices to say that experimental high intensity carbons have been produced having a positive crater brilliancy as high as 2,000 candles per sq. mm. Other improvements, apart from the light source itself, can likewise be anticipated.

Summary of Progress

Progress in adaptation of the carbon arc to the changing needs of motion picture projection can be summarized effectively by reviewing the advances made in respect to intrinsic brilliancy, color, efficiency of power utilization and economy of operation. The crater brilliancies of the various types of carbon arcs described in the foregoing text are summarized in Tables B and C. Improvement in color quality can be summarized by a comparison of the percentage of total light in each of the three primary color bands of the visible spectrum. This is indicated herein. Great improvement in efficiency of power utilization has been effected since the earliest days of motion picture projection. The major steps in this progress, as defined by improvements in projector carbons and lamps, are listed in their chronological order in Table D.

TABLE D. EFFICIENCY IN UTILIZATION OF POWER

Date	Type of Projection Lamp	Screen Lumens per Line Watt
1900-1918	D. C. low-intensity, condenser-type lamps	0.1 to 0.3
1918-1924	D. C. high-intensity, condenser-type lamps	0.4 to 0.54
1924-1926	D. C. low-intensity, reflector-type lamps	0.6 to 0.65
1926	D. C. high-intensity, reflector-type lamps	0.67
1931-1932	Simplified a. c. high-intensity, reflector-type lamps	1.7
1933	Simplified d. c. high-intensity, reflector-type lamps	1.85 to 2.05
1939	Low wattage, high-intensity lamps	2.35
1940	Simplified d. c. high-intensity lamp with $f/2.0$ treated projection lens	2.80
1941	New d. c. high-intensity carbon, condenser-type lamp with $f/2.0$ treated projection lens	0.93

Improved efficiency in the utilization of electric power in the carbon arc has been accompanied by corresponding reduction in the overall cost of operation. The relative cost of operation for equal volume of screen light is shown in Table E for the several types of lamps and carbon trims which have held a prominent place in motion picture projection. Current carbon prices and a power rate of 4¢ per KWH are used as the basis for this comparison.

TABLE E. RELATIVE COST OF OPERATION

Type of Lamp and Carbon Trim	Relative Cost per Hour per 1000 Screen Lumens
Early d. c. low-intensity condenser type	100
Later d. c. low-intensity condenser type	72
Early d. c. high-intensity condenser type	58
Present d. c. high-intensity condenser type	42
D. C., high-intensity reflector type with rotating positive	36
D. C., low-intensity reflecting type	24 to 32
60-cycle a. c. high-intensity	19 to 21
New d. c. high-intensity condenser type with $f/2.0$ treated projection lens	18 to 19
Simplified d. c. high-intensity with non-rotating positive	17 to 19
Low wattage, high-intensity	14.5 to 18
Simplified d. c. high-intensity with $f/2.0$ treated projection lens	12.5

Evolution of the carbon arc in motion picture projection, as indicated by the data here presented, has seen an improvement in color quality from the yellowish light of the low-intensity arc to the snow-white light of the high-intensity arc, permitting realistic reproduction of color features. The volume of light projected onto the screen has increased from a few hundred lumens to a possible 24,000. Brilliancy of the light source has been increased 13-fold, economy of operation 8-fold, and efficiency of power utilization more than 20-fold. The expectation of further progress in projection lighting as need arises is fully justified by developments which have not as yet passed beyond the experimental stage.

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PROJECTION ROOM DESIGN ADVANCES

(Continued from page 54)

lift is fitted into a fire-resisting shaft and is placed so that it has its bottom outlet on a street or alley wall, thus the film does not have to be brought through any part of the theatre. The film delivery man is given a key for the outside access door to the lift. At the projection room level the lift should terminate close to the rewind facilities and film storage space. Much pain and strain will be avoided in not having to carry heavy film deliveries to the projection level, and expensive interior finishes in the theatre are safe from damage with this simple new use of an old idea.

Trend Toward Much Larger Area

Observation port windows are now larger than they used to be, but it would be advantageous to have them even larger. It would be possible to make these openings at least 15″ square without any difficulty. This would permit the projectionist to have a better view of the audience when he is close to the opening, and at least to have a full view of the projected image when he is nearer to the lamphouse than to the opening.

The now numerous equipment pieces used for sound and visual projection, the advisibility of including 16-mm projection equipment, and the ever-present talk of new developments has convinced the theatre builder that the projection rooms should be more than ample in size. What was once an 8 ft. minimum for depth is now at least 12 ft. As for length, it is not uncommon to see the entire

width of an auditorium devoted to the projection room suite.

The modern projection room can more easily be kept clean because all wiring conduits are concealed and as much equipment as is possible is built-in flush into the construction. Floors are covered with linoleum or grease-proof asphalt tile. Acoustical treatment is usually confined to the ceiling with a hard perforated asbestos finish which has a fireproof mineral wool behind this finish. All surfaces are easily repainted and in no case rough and thereby dust-collecting.

Lighting in the projection room is now designed so that sufficient light is concentrated onto the working parts of mechanisms and control readings. The rest of the surfaces receive less light, but yet sufficient light so that there is not any sharp lighting contrasts leading to eye fatigue. Small lights may be placed behind the centre of the upper magazines to show when the film is about to run out.

Although a majority of projection rooms are now adequately ventilated, the use of an outside window or windows is desirable. This is accomplished more successfully by having the windows open off one of the projection auxiliary rooms rather than from the projection room proper, where it may prove troublesome because of daylight penetration. These windows are more useful for psychological reasons rather than for ventilation.

Last, but by no means least, is a matter which has reflected no credit on the exhibition field for too many years past—the need for adequate sanitary facilities for the projection personnel. The bald truth is that this situation heretofore is to the great discredit of both exhibitors and architects, since only the continued insistent pressure of the organized projectionist craft has finally prevailed to the extent where all new structural designs include such facilities, in addition to the many existing theatres which have been remodelled therefor. This matter, and that relating to the need for two exits from every projection room, reflect great credit on a craft that is increasingly alive and alert to the need for better working conditions for its members.

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NATION-WIDE THEATRE SERVICE

(*Continued from page 42*)

test instruments illustrated herein. Included in this kit are a specially designed battery-operated Voltohmyst, a Triatic Signal Tracer and Capacitor Checker, a Power Level Meter, a D.C. Ammeter and Shunt, Socket Selectors for checking tubes, and all necessary leads for instruments. All units are contained in a reinforced fibre case which is 19″ long, 7½″ deep, and 14″ high. The complete kit weighs only 35 pounds.

The Signal Tracer deserves special consideration, since it was developed and designed to fill a long-felt need for a universal tester. It will measure capacitors between 10 mmfds. and 10 mfds., and will indicate whether the capacitor under test has low or high shunt resistance. Headphones are not needed to secure a balance of the bridge circuit; this is accomplished by an electron-ray indicator tube. Because of the high-impedance input of the Signal Tracer, it can be connected directly to a signal-carrying circuit without appreciably disturbing the signal. This is a distinct advantage, since it permits checking of the electronic circuits in the theatre sound system under actual operating conditions.

In addition to this modern test kit, each field engineer is furnished with the latest Academy test film, which incorporates picture and sound excerpts from productions of the major studios. Other test films supplied include a buzz track and a 7,000-cycle recording for adjusting the optical units; a 300-cycle film for balancing photocell outputs and checking push-pull soundheads; a frequency recording from 30 cycles to 10,000 cycles for checking overall frequency response characteristics of the sound system, and overload frequency recordings for checking the power output of the amplifier.

Now Planning for the Future

While the equipment described is usually adequate for routine service work, frequently problems arise which require specialized test instruments. These are available either at the district office or in Camden, and can be furnished to the local engineer very quickly. Many problems anent acoustics, flutter in soundheads, mechanical vibration, and stubborn cases of amplifier trouble have been solved speedily by the use of these special instruments.

Plans for the future are now being formulated. While it is too early to do any concrete planning on theatre television, when television does come to the theatre RCA will be prepared with trained technicians and all necessary field service instruments. Our service organization has gained much valuable experience in the television art since 1936, when home receivers first became available, and other knowledge useful in this field has been acquired through work on radar and other ultra-high frequency equipment during the war years, and through close association with our research engineers.

No individual or local service engineer could hope to perform the specialized serviec job which an organization national in scope offers to exhibitors. No individual could keep abreast of the rapid developments in the electronic art or develop the broad plans so necessary for the future. Theatre owners are agreed that a national service company with a highly trained field force is the best protection for their theatre investments.

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PRESENT, FUTURE 16-MM PROJECTION

(*Continued from page 49*)

in the sprocket projectors. However, there will doubtless be 16-mm projectors for professional use which will utilize both methods of film movement, and since the advantages and disadvantages are rather evenly matched, it would seem that, depending upon production accuracy, either type can give an adequate professional performance in terms of film life.

Picture Steadiness, Motor Drives

The question of picture steadiness is also of direct interest to professional users of 16-mm equipment. Improvements have been steadily made in this factor so that professional standards with regard to jump and side weave are satisfactory up to the limit of the illumination sources available presently.

Current 16-mm projectors utilize universal governor-regulated-type motors for power, since they are generally required to meet field conditions of varying voltage and frequency that would render inoperative the standard type of induction motor. In addition, the projectors are lightweight, portable affairs wherein weight is at a premium. This will not be the case with the theatrical-type of 16-mm projector, which will be mounted on a fixed base; also, the motor is designed to run in only one direction, and rewind, reversing and stop-on-film features are eliminated. The average 16-mm projector now requires up to 1/10 h.p. for power, which requirement is not vastly different from that for 35-mm projectors with the standard Geneva movement. Therefore, future theatrical 16-mm machines will undoubtedly be equipped with the conventional type of heavy-duty induction motor.

16-mm equipment has had one advantage over 35-mm equipment in that when 16-mm was developed it was not an addition for a silent projector but an entity within itself—both sound and picture. This permitted a most economical and compact combination of sound and picture in one mechanism head, and future 16-mm projectors will doubtless all be of this type.

Present 16-mm projectors are generally inherently pre-

vented by their design from using lenses of the same speed in all focal lengths. This is due to mechanical clearance considerations only, which will be remedied in future models to accommodate the American Standards lens barrel specifications. Generally all lenses now supplied for 16-mm projection are coated, the speed of which is much higher than that heretofore considered as standard. Coatings now applied are durable, and when full advantage is taken of the reduction in stray light from the coating by suitable internal non-reflecting treatment, pictures of excellent contrast and sharpness result.

When 16-mm had sound applied to it, a decision was reached that the speed ratio be set as of the order of 2½ to 1 with reference to film travel at 90 feet, making a lineal speed of 36 feet a minute. Consideration was given to the making of 16-mm prints by optical reduction methods from the standard 35-mm negatives. Since a 2½ to 1 reduction in sound track width would effectively reduce the track width, if followed in this order, with a resultant increase in signal-to-noise level due to the relatively narrower track scanned, a reduction was set of .85% for the sound track width. This then has resulted in a 16-mm sound track of a standard width of .06.

16-mm Cylindrical-Reduction System

Considerations of portability generally have resulted in the selection of a cylindrical-reduction lens system for 16-mm projectors; whereas 35-mm systems utilize the mechanical slit with a low-voltage, high-current exciter lamp. The 16-mm exciter lamp for the cylindrical-reduction system most widely used is the 4-volt, ¾-ampere type, which generally [again for portability reasons] has been supplied by a well-filtered, high-frequency current generated in an amplifier the frequency of which has been upwards of 20,000 cycles. Since the exciter lamp has been so small in current and power capacity, a higher lamp standard had to be set; even so, exciter lamp microphonics and troubles due to defective lamps have been much more numerous with 16-mm than with 35-mm equipment.

The cylindrical-reduction system, however, inherently has a higher efficiency than that of the mechanical slit, and such a system, utilizing the 6-volt, 1-ampere prefocus

exciter lamp, has been in use in DeVry 35-mm equipment for the last six years. This lamp is more rugged than the smaller one and has demonstrated its ability to withstand theatrical usage over a long period of time. A 16-mm cylindrical-reduction system has been evolved utilizin this light source and has proven itself completely satisfactory with regard to microphonics and exciter lamp defects. We may find in the future, then, 16-mm professional projectors with the two types of systems—the cylindrical-reduction and the mechanical-slit types. In relation to performance, they are almost identical, it now being possible to consistently produce scanning beams of .00075 inch in section. This has made possible 16-mm performance almost identical to that of the 35-mm equivalent up to 6,000 cycles. At frequencies above this, 16-mm units drop off rapidly.

Now, as to performance, a 16-mm standard for scanning has been established by the specification mentioned previously and approximates closely that of the Academy of M. P. Arts & Sciences. This standard provides that scanning efficiency shall be such that, without reprinting the curve, the slit loss shall not exceed 5 db at 6,000 cycles. This has been realized and, as stated previously, the final listening results are so closely identical to 35-mm results that a trained listener can hardly discern the difference when the tracks are reproduced comparatively. This is true of fresh film only. When subjected to field distribution, 16-mm film obviously is inherently liable to a higher surface noise from damage in handling and the likelihood of obliteration of higher frequencies than 35-mm film.

The lower lineal speed of 16-mm film presents a more

severe problem in the reduction of flutter than that encountered with 35-mm film and it therefore becomes a problem of high precision in the reduction of film flutter through the selection of bearings and the choice of the mechanical-filter system. This problem has been solved, and future 16-mm theatrical projectors will have a speed variation not in excess of that permissible for 35-mm sound reproduction. In fact, the flutter as measured on the RCA type of flutter meter has been reduced in professional 16-mm equipment to between .2 and .3%.

Frequency Response Standards

When prints are released to a standard frequency specification, no fundamental differences exist with regard to the amplification systems as between 16-mm and 35-mm. Prints are not standard with regard to their release characteristics presently, however, and a standard is being formulated for such professional use. The past portable nature of most 16-mm projection equipment, with the wide variation in response characteristics as released by various producers, when coupled with the bad acoustical conditions involved generally, has made mandatory the use of tone controls which could be adjusted, thus compensating for poor conditions. For theatrical use tone controls cannot be tolerated, and once a theatre amplifier is adjusted for best reproduction, it is assumed that print quality will be maintained to a standard as selected, without necessitating any theatre adjustment of the system.

The aforementioned variations in frequency response characteristics, as used by the producer, has reacted very badly with regard to general showings, and this, coupled with the essential portable nature of the loudspeaker systems, has prevented high-quality 16-mm reproduction. Understandably, with an improperly baffled loudspeaker, plus the tendency of many users of portable equipment to accentuate the low frequencies, the end result has been very high factors of intermodulation distortion in the output from the speakers and the overloading of amplifiers. When 16-mm film is recorded properly to take advantage of correct standard reproduction, and the amplification system is terminated in a correct speaker system of theatrical quality, a vast difference is immediately realized in profesisonal potentialities.

Portable amplifier equipment generally has been based on very liberal distortion allowances. For example, the R.M.A. rating of amplifier distortion allows amplification systems to be rated as to the very maximum power obtainable from an amplifier, excluding the factor of distortion, and this, combined with the seldom-mentioned factors of power output at 5% distortion level, represents the type of amplification generally supplied with 16-mm equipment in the past. Professional sound reproduction equipment should have, and will have, the same low distortion level as that for theatre equipment recognized as standard at this time, which in essence is not to exceed 2% over the frequency range covered.

This discussion of the present and future of 16-mm equipment has, of necessity, been a very abbreviated one, but the writer hopes that it has clarified many current questions anent professional 16-mm projection. Obviously, 16-mm equipment will not replace 35-mm in the main, due to inherent limitations of illumination where large screen sizes are involved; but it is certain that it will furnish a valuable secondary theatrical market and one which will be very successful if professional personnel be used for its operation.

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'IF IT ISN'T ON THE FILM . . .'

(*Continued from page* 38)

tensity for photography, the problems involved in obtaining sufficient projection light to fill a twenty-foot wide, or larger, screen become serious. Special process background projection lamps have been designed and manufactured which have water-cooled positive carbon contacts, photoelectric cell-controlled positive carbon position devices, resistance-balanced arc voltage controls, and many other exclusive features.

The requirements for light on these process projection screens are so great that multiple units, known as triple projectors, have been manufactured. As the name implies, these units consist of three complete projectors, one facing the screen and the others at right angles projecting their images onto front surface mirrors which redirect them to the screen. In this manner three identical prints may be projected into the screen thereby raising the level of illumination almost threefold.

It is quite true that "If the picture isn't on the film, you can't put it on the screen." It is also true that if the picture *is* on the film the responsibilities of the projectionist parallel those of the cinematographer. He must balance his auditorium illumination so no bright colored objects will interfere with the picture, and he must see that his projection light source is of the correct intensity and quality so the action in the picture will always be the high point of interest. *The screen image is formed by the projection light source,* and the film acts only to reduce or absorb certain of the rays from that light source.

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STUDIO PROJECTION ENGINEERING

(*Continued from page 22*)

and 5-amp ammeter in the exciter lamp circuit. These are connected with a relay that is controlled by the motor switch. When the machine is stopped the compensating resistors cut in and the exciter lamp burns at 1 ampere. When the machine is started the compensating resistors cut out and the lamp burns at full brilliance, which is predetermined by running balancing 1000-cycle loops. By this method lamp life is prolonged and adjustments due to lamp efficiency changes are cut to a minimum. This modification may seem elaborate, but when it is considered that each time a new exciter lamp is installed the push-pull circuit must be re-balanced, it is easy to appreciate the value of prolonging exciter lamp life. All of our exciter lamps are selected for straightness of filament and we preset all prefocused base lamps by the use of an alignment instrument.

Critical Pre-Run System Check

In line with the policy of leaving very little checking to the "look and touch" system, we use an aligning assembly to check the position of our entire projection optical system. This assembly is similar to the Simplex double-shutter aligning tool. It consists of a bushing that clamps into the lens mount and a square bushing that fits into the aperture. Through the center of these two bushings is drilled a 3/8" hole through which is insterted a 3/8" rod. This rod is sharpened to a point on one end. If the bushings are clamped in place and the point of the rod meets the center of the positive carbon, it is obvious that lens, aperture and lamp are in line.

A thorough routine check of the sound in each booth is made periodically. The procedure followed and the testing equipment used is as follows: checking procedure from a sound standpoint begins by turning the booth fader wide open, cutting off the stage speaker voice coils by compensating switch and resistor, turning monitor

volume full on. Machines are now turned over and run, and if machine noise be present, the first step is to eliminate it by adjusting whatever esems to be the cause—exciter position, lenses, mounts, microphonic cells, etc.

Next step, assuming system is crisp (free of tube noise, microphonic tubes etc.) is to run Academy test reel ASFD No. 1 which has 15 frequencies from 40 to 8000 cycles. By plotting the curve from the V.I. as film is run one can readily tell if curve is standard Academy or if it has dropped off at the high end, or if changes have occurred since the last time one took the previous run (curves are run every day at M-G-M). Dirty lenses, photocells and gassy tubes are the biggest cause of high-frequency drop off. Photocells will also cause an increase in bass response as well as a high-frequency drop.

To check pad-roller adjustment we use the Academy standard buzz track No. ABZT and follow by running the Academy standard scanning illumination test track No. A17P-1 to make sure we are scanning properly. We record a 200-mill, push-pull, 1000-cycle track which we run to balance out the push-pull circuit. By using the V.I. we adjust potentiometer to a minimum reading, and by the amount of cancellation we get from this test we know to what extent our push-pull circuit is functioning. To measure flutter a specially built flutter meter and special track is used. We use a slow-tempo piano track to test for speed variation, plus a visual test with a General Radio Co. Strobotech. Experience shows the test track is a very satisfactory method. When we have completed all the aforementioned tests, the stage horn voice coils are turned on again and we put on the Academy test reel

No. ASTR-3 and listen in the auditorium to the quality. Other test instruments used are a Weston model No. 772 20,000-ohm-per-volt meter analyzer, a Hickok dynamic mutual conductance tube tester, a 20-to-20,000 cycle audio oscillator and gain set, a -30 db. volume indicator box, a model 75 Aerovox capacity bridge, and a Strobotech.

Due to the great amount of heat generated in the sound lens we find that oil is condensed inside, consequently these lenses are watched very closely and cleaned when necessary. We build a special tool that, fitting around the lens barrel, has an adjustment screw extending through the handle against the soundhead base. The use of this tool enables us to get a very close adjustment of azimuth and focus. We use a special 200-mill, 8000-cycle loop in this operation.

The foregoing should give some idea of the work of the studio projectionist and studio projection engineer. Due to the scarcity of equipment and parts during the war some of our projection installations are not as up to date as we would like to have them. The department is at the present time in the midst of a modernization program which will insure even more efficient reproduction results than we are now getting.

We have tried to give you a word picture of not only our work but also the extent to which our entire department goes to insure good projection reproduction of our product. In addition to the electronic, mechanical and optical maintenance, there is still another important factor. That is the film we handle. Each scene, of necessity, is projected many, many times. That means danger of scratches. Rails, shoes, idlers—in fact, every point of film contact—is continually checked for abrasions which could cause scratches. Rewind, upper magazine and take-up magazine tension is watched very closely. The film is checked periodically. If it is too damp the emulsion is soft; if too dry it is brittle and buckles. We continually watch the water content of the humidifying cans under the film cabinets. In other words, we are faced with the same problems as we had when we worked in a theatre, except for the type of audience.

We would appreciate any comments and will be glad to answer any questions. We would also appreciate any tips on projection service expedients which you might care to pass along. All communications can be addressed to us at the M-G-M Studio, Culver City, Calif.

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The Stage Mechanic Takes a Bow

By WALTER J. MAHER
I.A.T.S.E. Local No. 1, New York City

LITTLE is said or heard about the men who labor back of the proscenium arch and footlights of the modern theatre. Few of the audience, as they witness the scenes unfold with mechanical perfection, know the contribution these men make. All others—the designer, producer, musical director, dance director, members of the cast—all receive due recognition and are usually mentioned either in the program, trade magazine, or the public press.

The importance of the technical side, and of the men who contribute so much in this field for the successful operation of the stage, cannot be over-emphasized. The necessity of a proper background and atmosphere in which the actors are asked to perform is an important consideration in the casting and the planning of the play. How often has it been said that this or that play did not get over because it was poorly produced; by the same token, plays have been successful and have had long runs because they were beautifully staged.

The theatre stage and operation is distinctly divided into three essential departments: the carpentry, electrical, and property divisions. These departments, and the complement of men assigned to each, function independently of each other but coordinate their particular duties to bring about the desired mechanical perfection.

Term 'Stagehand' a Misnomer

The term "stagehand" is improperly used to define adequately the duties of men working in the various theatrical departments. These men are mechanics in that they have by training and experience qualified themselves for work in all three departments. Many of the mechanical improvements in lighting, settings, and properties are directly attributable to them. Men engaged in the theatrical crafts—the carpenters, electricians, and property makers—are working in a highly specialized field in which the work performed is peculiarly different from the work performed by tradesmen engaged in allied trades outside of the theatre.

In order to clarify the duties men perform backstage, let us see what actually takes place from day to day with a show that is about to be produced. Assume that it is a heavy musical comedy requiring a large cast, massive settings, adequate lighting equipment, and numerous properties. The cast is selected after careful screening. The designer is consulted and, after reading the script, submits plans and specifications with regard to settings, properties and lighting equipment.

At this point in the planning members of the IATSE are engaged by contract to serve as Heads of Departments. They are known as the production crew, which is usually comprised of a carpenter, electrician, and property man. When the production is heavy, each of the Department Heads also has an assistant. The carpenter, besides, requires the services of a boss "flyman." While it is the business of the designer to plan the settings, including the necessary lightings and properties, he must solicit the advice of the various Department Heads with regard to the constructional details, keeping in mind the practicability and facility of movement, an important factor if a show is to meet the physical requirements of the theatres in which it will play.

Scene changes, intermissions between acts, number of men required to handle equipment are all constant factors which must be given serious consideration. Estimates are furnished for the construction of the scenery, lighting equipment and property. When the contracts are made, actual building begins. When the latter is completed, the show is ready to be put on.

A Typical Big-Show Procedure

Few shows open in New York. It has been the policy over the years to play to audiences in nearby cities, such as Boston, Philadelphia and New Haven. This is called the breaking-in period, during which time changes are made according to the reaction of the audiences, working conditions, and press notices.

Let us assume that the opening will be in Boston. Arrangements are made for the transportation of equipment, the cast and all others connected in any way with the production. All relative information, including the number of men required to take in and put on the production, is sent to the theatre designated. The time of arrival is specified and all is put in readiness so that nothing will retard the scheduled opening performance. Upon arrival each of the Department Heads directly responsible proceeds to take in and set up the material to be used in their respective departments. Work continues regardless of the hour, and when completed the call is made for complete rehearsals. There is a variance in the number of men required to take in and put on and the number necessary to work the performance in each department. This is determined usually by the physical set-up of the stage, and the complement of men is accordingly called for by each Department Head.

In the Carpentry Department, which of course has to do with the scenery, all men are assigned to their specific duties, some working on the stage floor, or "deck" as it is called, and others as may be required in the "flies" to handle all pieces which will hang in the air and be controlled by a system of counterweights which makes it possible to let them in and take them out at the proper time. The work performed by the "flymen," as they are called, is supervised by the boss flyman under the direction of the carpenter. Men working on the stage in this department are called "grips" and move pieces of scenery into position as required. Whatever task is assigned to men in this department during rehearsals is carried through faithfully throughout the run of the show.

Lighting, of course, is an important part of the production and requires additional equipment over and above

(*Continued on page* 95)

THE MELTING POT OF THE I. A.

(*Continued from page* 30)

with the cooperation of the International Ladies' Garment Workers Union.

Although the work done by these custom tailors and dressmakers is partially studio work, and although they have many problems in common with us, their jurisdiction is properly that of the I.L.G.W.U., and the organizational drive is now being conducted by the latter with slight financial and much organizational assistance from the Costumers. Upon completion of this drive, every custom tailor, dressmaker, milliner, shoemaker, hatter and jeweler, as well as every costume maker in the Hollywood, Los Angeles and Beverly Hills area, will be organized.

With hundreds of small custom-made shops in the area, many organizational problems have confronted us which are being solved only because we have received at all times the utmost cooperation from the I.L.G.W.U. and the Amalgamated Clothing Workers as organizations and as individual members.

Compiled Splendid War Record

Organizationally, our problems have been complex. We have a large number of very low-paid ($1 per hour and under) but skilled members. Due to the existing prejudicial wage differentials our turnover in labor supply has been immense. But despite all this, our members have shown a willingness to back financially and physically every charitable, patriotic or labor organizational plea that has been before them. During the past year we have contributed to organizational drives for television, 16-mm., garment workers, projectionists and registered nurses. Throughout the war years the Local took an active part in the Red Cross, War Bond, War Chest and other drives. Within the past month 15 members contributed from one to ten days each in securing, cleaning, pressing, and repairing costumes to be sent to the world-famed Belgrade

Theatre to replace the wealth of costumes destroyed by the Nazis during the war.

The organization is especially proud of its veterans' program. Throughout the war years thousands of dollars were raised and spent on behalf of not only our own members in the service but members of other unions, friends, relatives and workers in the industry. Every type of service requested was given to the servicemen including gifts of food, money, publications, and the sending of letters and bulletins from both the Local and individual members. We believe that we were the first union to subscribe to the A.F.L. Veterans' Rehabilitation and Employment Program which has been operated since 1944 under the direction of Dr. Robert Ziegler, a member of the American Federation of Musicians, and Chas. Vencill, secretary of I.A. Projectionist Local 150. We have continued to contribute to financially and support in every way this organization which has the reputation of being the finest veterans' union program to be set up in the United States.

Also, in 1944 our members voted a sizeable portion from our treasury to be set aside for our own veteran members upon their return. Since then this fund has been added to by further contributions from our union treasury, from individual members and friends, and from proceeds secured from a benefit dance held in 1945. Additional money was raised at another benefit dance which was held on July 6th. This money has been used to pay dues for returning veterans, to take care of initiation fees of new veteran members, and for grants and loans which are made to veterans without red tape, delay, or interest.

Since the costumers are a new organization within the I.A. and are not well known internationally, our activities have received little publicity throughout the International. With the diversity in age, race, creed, political belief and nationality, with the many different job duties, training and skills of members and their wide background of union experience, the Local has demanded honest, democratic, progressive unionism within its own ranks. Our members are proud of their organization, are working toward a strong unified union, and are intent upon becoming a powerful influence for everything best in trade unionism.

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CASE HISTORY OF SIMPLEX PROJECTOR

(*Continued from page* 34)

3. An entirely new gate and film-holding structure to maintain the film in the correct optical plane above the intermittent sprocket.

4. Complete enclosures for the mechanism, all prior mechanisms being of the open type with gears exposed.

5. The method of framing the picture in the Simplex mechanism.

6. An improved film-gate door lock, enabling the projectionist to easily close and latch the film-enclosing gate.

7. An entirely new design of fire valve for film magazines.

8. An entirely new type of mechanically-controlled variable-speed device for use with constant-speed motors on projectors.

Along about this time (1915) there came into being another film equipment market the social, political and economic implications of which can be appreciated only by those who have watched it grow from its humble beginnings to its present preeminence as one of the most vital factors in the dissemination of intelligence which affects the thoughts and actions of people in every land on earth. This was the non-theatrical motion picture field.

So vast is the influence exerted by the non-theatrical film that it would require much more space than is available in this entire edition to begin to do justice to the subject. Suffice it to say, however, and merely as a footnote herein, that International Projector Corp., at first with the Acme portable projector and later with the Simplex-Acme sound-picture projector system, contributed handsomely to the development of the non-theatrical field at a time when this market was sorely in need of just such technological stimulus. A measure of the worth of the Simplex-Acme sound-film projection system may be had from the fact that more than 200 movie theatres are today and have been for years using this equipment.

Form International Projector Corp. in 1925

The corporate existence of International Projector Corp. dates from 1925 as a result of the merging of Precision Machine Co., Nicholas Power Co., and the Acme Motion Picture Projector Co., with all manufacturing facilities and personnel being concentrated at 90 Gold Street, New York City.

This consolidation ushered in a new era of development in projector manufacture, one of the early fruits of which was the Super Simplex mechanism. This projector, while resembling to some extent the older regular Simplex mechanism, embodied many improvements making for better visual projection, greater ease of operation, and considerably more efficient handling of the lens system. A great improvement was made in the intermittent movement by the development at the plant of machinery for manufacturing the operating parts of the movement, that is, the star wheel and cam, and for obtaining far greater accuracies than were obtainable previously.

An interesting sidelight on the precision work demanded for a modern projector is the fact that the highest-rated manufacturers of accurate instruments in America frequently refused to guarantee that the tolerances indicated on projector company blueprints would be met. Thus, projector manufacturers were forced to devise ma-

chinery and techniques to do the job in their own plants. How this task was accomplished is a fascinating story in itself, but it seems imperative that it be stated here that great industrial combinations who handle electronic and other products requiring hairline accuracy of design and manufacture, and with tremendous plant equipment and technical brains in fulsome measure, long ago resignedly abandoned trying to duplicate projector parts and regularly assign this task to projector manufacturers.

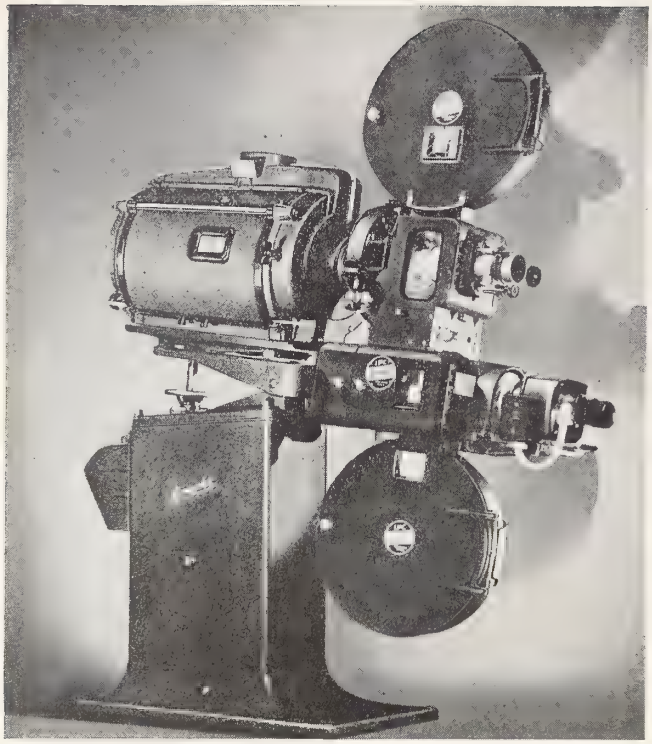
Another major Super Simplex development was the removal of the revolving cut-off shutter to the rear of the projector so that it interposed between the illuminant and the aperture plate. The many advantages of the rear shutter are so well known as to need no recounting herein. Other Super Simplex improvements involved a new type pad roller arm for accurately maintaining the film on the sprockets, a threading lamp for quick and accurate framing before projection, and an assembly of enclosures for the entire mechanism.

The introduction of sound pictures posed a threat to projector manufacturers, and particularly to International Projector Corp., not at all connected with technological problems. The major concern for a while was the development of the General Electric P2 visual and sound projector which, its sponsors hoped, would be adopted by RCA and at one fell swoop put the skids under both Western Electric Co., on the sound unit end, and the projector manufacturers on the visual unit end. Through a series of (for both W. E. and International) fortuitous happenings, not the least important of which was the wholly unsatisfactory performance of the G. E. job, the P2 projector was short-lived and ultimately was replaced by standard units.

Now occurred one of those entirely unforeseen and wholly unpredictable situations which resulted in t virtual elimination of the Powers projector from the theatre field. Sound reproducing equipments made by W. E. and later by RCA were in the beginning made for adaptation to the Simplex projector only, this being because several of the large-circuit early buyers of sound equipment were largely equipped with Simplex mechanisms. So heavy was the first wave of sound equipment orders that neither W. E. nor RCA paid any attention to the development of a unit for the Powers projector.

This circumstance, although a mortal blow to the Powers mechanism, was in some ways a blessing to the industry because it resulted in the replacement of a tremendous number of Powers units by new Simplex equipment which was destined to render yeoman service to a harrassed industry in the dark depression days that were to follow. As a matter of fact, RCA Photophone early took the stand of refusing to install sound equipment unless new Simplex projectors were also installed, regardless of the condition of the projectors then in use. Despite this blow, not a few Powers projectors still are functioning in small towns throughout the country—no mean tribute to the sturdiness and accuracy of this mechanism with so honored a name and so superb a record of performance before it was obliterated on the sands of time by a tidal wave of technological change.

Another important development which projection peo-



The Simplex E-7 complete with base and soundhead.

ple are all too prone to forget but which may precipitate another technological earthquake in the not too distant future concerns an old friend, wide film. In 1931 International introduced its Grandeur equipment to meet the demands of so-called "wide film projection" which was climaxed by the Fox Film Corp. showings of *The Big Trail* and *Happy Days.* The economic dog days were upon us by mid-1931, however, and the Grandeur equipment was put away in moth balls. Certain features of this system, however, merit a brief description herein.

The Grandeur apparatus, originally intended for 70-mm film but subsequently modified to conform to the S.M.P.E.-approved standard of 50-mm film, has been completely developed and reflects a projector which in many respects is of a fundamentally new design. The mechanism operates entirely in an oil bath and is constructed so that either wide or standard film may be projected with equal ease merely by throwing a few levers. The sound system is incorporated as an integral part of this mechanism and is also easily adaptable for either 35-mm or 50-mm sound tracks.

Other features of the Grandeur equipment are: positive fire prevention devices; a lens turret providing for the use of three separate focal-length lenses, each having lateral, horizontal and vertical adjustments, with the entire turret being rotatable for proper lens selection; the equipment is directly driven from a motor suspended beneath the mechanism in a compartment of the projector base, there being no belts or chains of any type used therefor; a new type take-up attachment which depends entirely upon the weight of the film in the lower magazine to properly adjust the tension of the take-up; and many fine adjustments of the supporting stand proper so that this massive equipment might be adjusted laterally, horizontally and vertically with the utmost ease.

Current reports from various laboratories lend color to the belief held by many well-informed technicians that the professional projection field has by no means seen the last of equipment such as the Grandeur system. In fact, it would surprise practically nobody except a somnolent few if wide film were the next great advance in film presentation.

This story would be meaningless indeed if it failed to include two other outstanding developments by International Projector Corp.: the Simplex Sound System and the Simplex E-7 projector, both of which equipments are even now being bought in large quantities as representative of peak performance in the reproduction of the picture and its accompanying sound. Both developments are of such comparatively recent origin and have been so minutely described in hundreds of columns of words and pictures in the industry trade press as to make repetitious any detailed statement herein.

It may be said in passing, however, that the Simplex Sound System was particularly a child of fortune in that it was designed and manufactured at a time when the

sound reproduction art had long since emerged from its cocoon and was already the beneficiary of many notable advances which made for superior performance by vastly improved circuits, better tubes and speakers, greatly enhanced recording and other factors which enabled a compact reproducing system that shamed the early models of sound equipment.

As for the E-7 Simplex projector, this development reflected the many changes which technicians were itching to make but were prevented from instituting by the prolonged economic depression of the early '30's. When they got around to the doing of these things, however, they really poured it on and produced a mechanism worthy of the fine craftsmanship which down through the years was a promise iterated and reiterated that someday there would be a mechanism worthy to incorporate the fruits of so much brains, so many hands and so many heartaches.

Thus was staked out the long, long road leading from the Eden Musee of 1896 onward and ever upward to the magnificent motion picture theatres of today which, by comparison with the Eden Musee, are truly palaces worthy to house a living, vibrant art that daily endows so many with so much for so little. Verily, a promise has been redeemed.

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MODERN STAGE LIGHTING

(*Continued from page* 14)

of the asbestos curtain, augmented by 24 reflector-type units installed in one of the auditorium coves. The customary stage pockets dot the floor, all arranged for four colors for the plugging-in of portable equipment, of which we have a goodly array from baby spots to 5000-watt Fresnels and Kliegsuns.

The Thyratron-Controlled Switchboard

One of the most outstanding contributions to the art of stage lighting was the development of the Thyratron-controlled reactor type switchboard. This system of control makes it possible to have such a large scale lighting plan at the Music Hall. With its 314 individual controls, any other known system would have required more space than is available on any stage. Due to this design, we were enabled to locate our light console in front of the orchestra pit within a space of 6 by 15 feet.

In addition to space saving, there are other features inherent to this control. It provides for presetting of intensities, as well as switching on the circuits in advance for any number of scenes for which it may be designed. It provides means for fading through from one scene to another, so that as the previous scene lighting is being dimmed down the succeeding one is being dimmed up. Proportional dimming is another of its features wherein the various preset intensities dim up or down at the same time so that the proportion of the lighting set is not disturbed from full bright to completely out.

To augment our incandescent lighting, and in addition to the arc-spot lights on the stage towers and side bridges, we have a number of high-powered arc-spots located in the auditorium ceiling cove and spotlight booths. Arc-spots cannot be dimmed as conveniently as the incandescents. Yet in our lighting it is frequently desirable for the arcs to fade out simultaneously with the incandescent lamps, or to obtain a simultaneous blackout of all lights. To accomplish this, each one of the arc lamps was equipped with a Selsyn motor-operated shutter, connected to the light console, whence it can then be operated at will.

To supply direct current to the arc-spots 18 motor generators were installed, ranging in size from 50 to 75 KW. Two special 6- and 8-cycle, 25-volt motor generators supply the motive power for the Selsyn color-changing device on the incandescent spot-floods.

The author of a book on the drama called the stage a "graphic art, where truths, myths, fables, ideas and ideals are revealed to us through the media of language, action, form and color."

Color begins, of course, with light. In stage lighting we have the means to make our colors change in hue, tone and tint at will by the use of colored light in varying intensities. In the Music Hall we work with more than 40 different colors and tints in our illuminants. Gelatine

filters of these colors are constantly kept in readiness. Each piece of lighting apparatus has its own complement of filters, of which we have many hundreds placed in cabinets adjacent to the equipment. This system saves many precious minutes during the limited time we have for rehearsals.

As mentioned previously, color in the lighting enhances the color of the set as well as of the costumes. The pigments applied in scene painting have little reflectivity in themselves, perhaps as much as the moon, whose own light is extinct and becomes visible to us only through reflected light obtained from the sun. In a similar manner, pigmentary colors appear only in their true nature when viewed by reflected light of a suitable wave-length. To supply this suitable wave-length is the purpose of color in our lighting.

While there is a scientific method of color mixing—such as the use of harmonious colors for one scene, complementaries for another, combination of the primaries, superimposing or juxtaposing for higher contrast—the variable nature of the materials we work with on the stage frequently compels us to use the trial-and-error method in obtaining our results.

In planning our lighting, we are guided by the artist's design of sets and costumes, together with the action on the stage, observed during company rehearsal. A light plot is prepared in advance of the light rehearsal, copies of which are given to the personnel at the various light stations, and during light and full dress rehearsal necessary modifications and corrections are made in this to suit the varied conditions that may and do arise. In the final execution of the lighting plan each and every member of the lighting personnel [all members of Local No. 1 of our I.A.T.S.E.] is depended upon to weld this complex system into a unified whole.

Postwar developments of light sources will, without doubt, enlarge the scope of stage lighting technique. We are looking forward to more powerful, cooler light sources which will be more concentrated, approximating the point source of the carbon arc. These newer light sources should, of course, contain all the visible wave-lengths of the spectrum, to permit the unhindered use of color media.

There is need for the development of a colored linear light source of small diameter, such as the hot- or cold-cathode florescent tube, which would be capable of rendering color in a more efficient manner than our present absorption method. It must, however, permit of proper control for dimming from full bright to completely out. Such color units could be used for overhead general lighting, where they would furnish continuous rows of efficient color, instead of having to space our colors anywhere between 16 inches and 4 feet, depending on the size of lamp and reflector being used.

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TESMA—The Men Who Make the Equipment

By ROY BOOMER

Secretary-Treasurer of TESMA

EVER since the first theatre for the English drama was erected in Shoreditch, England, in 1576, the manufacture of theatre equipment has been an industry. In the early days of the theatre, opera chairs, spotlights, stage rigging, scenery and house furnishings were the principal items manufactured. Just before the turn of the twentieth century, the American public saw its first motion picture. It was at about the same time that the I. A. T. S. E. was founded. Down through the years the I. A. and the manufacturer have cooperated in presenting to the public a higher type of motion picture entertainment and legitimate theatre presentation.

Research, designing and development have played a great part in the success of modern theatre entertainment. It has also taken a great deal of study, experience and

schooling by the projectionists to efficiently produce the effects that the equipment was intended to. So that the mechanical operation of projection room equipment would be flawless, many I. A. local officials had the foresight to institute instruction courses for their members so that all might familiarize themselves with existing equipment as well as that in the development stage. The knowledge thus gained has been beneficial not only to the projectionist but to the manufacturer as well.

Some ten years ago the Theatre Equipment and Supply Manufacturers Association, commonly referred to as TESMA, was organized. This non-profit organization provides a common meeting ground for the exchange of ideas, constructive criticism, suggestions, etc., and a general clearing house for information pertinent to the members' welfare. TESMA promotes a better understanding between manufacturer, dealer, and exhibitor. To accomplish this, TESMA has a "Common Council" composed of manufacturer, dealer and exhibitor to work out a joint program along this line and to function for the mutual benefit of all. TESMA conducts an annual convention and trade showing in conjunction with the Dealers Association, to which exhibitors are invited. The convention this year will be held in Chicago on September 30, October 1-2-3. ★ ★ ★

Film Changeovers

By LARRY STRONG

Essannay Electric Mfg. Co.

SOME 30 years ago when Barbee's Theatre, Chicago's first de luxe theatre opened in the "Loop," the writer was employed there as a projectionist. This theatre was in a reconverted business building, so naturally the projection room suffered. Between the two machines was an iron pillar about three feet square, flush against the front wall, so the then-conventional way of making changeovers by means of a sliding rod could not be used. Through the employment of various strings and pulleys, however, a method was worked out where one dowser in front of the lamphouse could be opened and the other closed in a fairly effective manner. While this worked, it proved a very unsatisfactory method of changeover.

It was then that the writer began experimenting with an electrical means for making a changeover, and wi the aid of a few enunciator drops operated by dry cells this was accomplished. This was the first electric changeover to be brought into practical use in a projection room. From this crude beginning at Barbee's Theatre in Chicago emerged what was considered at that time to be the ultimate in a changeover. This equipment had a pair of blades that worked on the scissor principle, actuated by a double solenoid. It was mounted directly over the port opening. This model was also operated with batteries by means of a wall push-button. Other projectionists who visited Barbee's saw this changeover and wished to acquire one. Thus was born the changeover business.

As the projection art progressed various changes and new models of changeovers were developed. The foot-switch was introduced when sound came in. About that time, when sound had gained a foothold, the aperture-type changeover was introduced, and the changeover came off the front wall. Today the modern changeover is of the aperture-type, as it cuts the light where the beam is the smallest and, naturally, the action is faster. An additional safeguard against fire hazards is also provided.

The next forward step was the combination sound-picture changeover. This is accomplished by means of a switch built into the unit itself and actuated by the armature of the changeover. This provides instantaneous and synchronized change of both the picture and sound. It is possible today to get this type of changeover, which not only changes the picture but the sound in the same operation where stepping on the foot-switch changes over both.

A typical two-projector hookup is shown in the accompanying wiring diagram, although it is possible to equip for as many projectors as required, all operating so that stepping on a foot-switch of a particular machine will open that dowser and close the dowsers on any machines that might be open. Remote control switches can also be installed in various parts of the room where required, so as to close the dowser of any running machine, at any time. The aim of the projectionist is a perfect show. The purpose of the modern changeover is to help him attain this goal.

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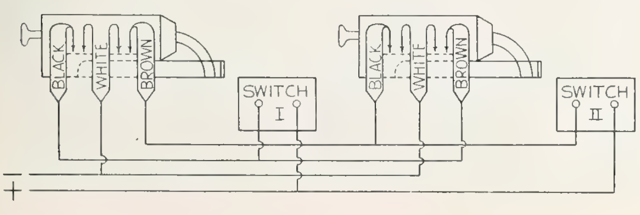
Wiring diagram for the Strong "Zipper" Changeover.



THE STAGE MECHANIC TAKES A BOW

(*Continued from page* 86)

what is found in the average theatre. The installation of this takes many hours, when we consider portable boards, wiring cable, and other special equipment to take care of spotting and general scene lighting. The front spotlights are operated usually by a man who is one of the crew and who is familiar with the cues. Additional men are engaged in each theatre, according to physical requirements. The men working on the stage proper required to handle the lighting equipment during the scene changes are called "operators." The man or men working the portable boards which control the lighting for the show are termed "portable board operators" and, of course, work on "cues" decided upon during lighting rehearsals.

The Sum of All the Parts . . .

The property department is responsible for everything coming under the heading "properties," such as furniture, draperies, bric-a-brac, pictures, prop trees, and other materials used to dress the set; also for hand props used by performers as a part of their costume or to depict the character they are portraying. The men handling properties are known as "clearers" and perform the duties assigned them during rehearsals throughout the run of the play.

We come now to the opening performance. Careful

(*Continued on page* 97)

Industry's Autocrats: the Film Editors

By NATHAN 'CY' BRAUNSTEIN
Motion Picture Film Editors
I.A. Local 771, New York

MOTION pictures is a highly specialized business in which one must be a specialist to survive. It has grown from a novelty to a gigantic enterprise largely because the right people in the right jobs have advanced it artistically and commercially, and continue to do so. The film editor is certainly not the least important industry factor. He it is who assembles the film as it comes from the camera and puts it into continuity to make it a coherent play. After the director, cameraman, soundmen, technicians, and others have finished their work, it is the film editor who must separate the chaff from the wheat and select only the best of the material at hand. This task requires intelligence and good judgment plus a competent knowledge of story construction and photography.

The editing of motion pictures requires more than a pair of scissors and a splicing machine. An inexperienced film editor can ruin a fine picture; and by the same token a competent film editor can enhance the value and box-office appeal of a picture manifold by judicious editing. The film editor is like the architect who draws a set of plans for a building. After the plans are drawn and have been approved by the proper authorities, they are turned over to the builder with instructions to build as per the plan or blueprint. In fact, the film editor might truly be called both architect and builder, for he combines the functions of both.

Preliminary Steps in Editing

A producer dumps, perhaps, 300,000 feet of finished picture or "rushes"—negative, positive, sound tracks, effects tracks, music tracks, etc.—into the editor's lap and says: "There it is. Cut it down to 8,000 feet—*but* give me a *picture!*" Just like that. From here on the ability, imagination, vision and special skill of the film editor is necessary. From this point he is on his own, with the producer, cameraman, director, author, actors, and company officials all waiting eagerly for the finished results. A great responsibility now rests upon the shoulders of the film editor. He goes at the job with the same feeling as if the money invested in the celluloid were his own.

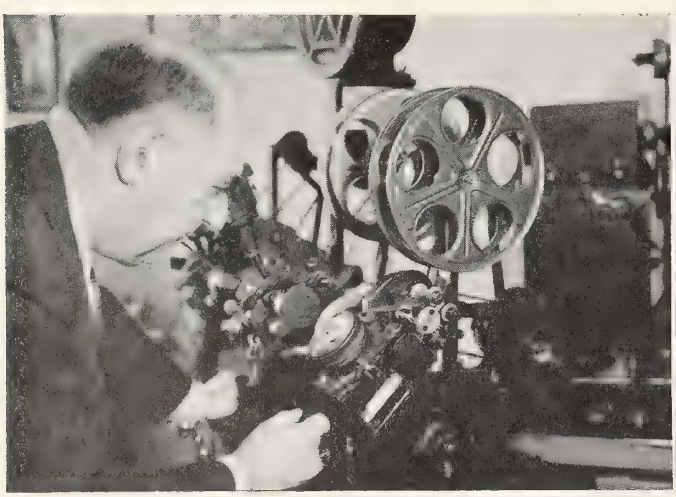
The first thing the editor does is to familiarize himself with the script of the picture he is about to edit. With the story of the picture in mind, he starts to work. With his Moviola he examines the film, scene by scene, and selects the best. Now he does the same thing with the dialogue tracks and the effects and music tracks. This is called a "rough assembly." This first procedure may eliminate several thousand feet of unusable picture. Then the entire lot is again run through the Moviola and more eliminations are made. Finally, after a lot of painstaking work, he gets down to a "rough cut" of the picture.

This "rough cut" may be fifteen reels in length—that is, fifteen reels of talk track, fifteen reels of music, fifteen reels of sound effects and fifteen reels of picture. The editor still has a lot of work ahead of him, for the producer wants only an 8,000-foot picture. That means boiling everything down—all tracks and all picture to one composite entirety—effects, talk, music, and action on one film 8,000 feet in released length. But, a *good* picture; that's what the producer wants.

Many Projections Precede Final Cut

From here on the experienced editor will work a few miracles. He must always please the stars, author, director, cameraman, soundmen, and producer, for they all have certain "pet" scenes they want used. Unfortunately, these "pet" scenes are not infrequently those that grace the cutting-room floor; their use would have hurt the picture. By discarding them the editor has used good judgment and helped the picture. The editor is at all times impartial and will always listen to reason and experienced advice. He does not rate himself a master-mind or a superman.

Before this roughly edited picture has reached the final cutting stage it may have been projected ten or more times on a large screen to pick out spotty action and various flaws in sound, direction and acting—and, of course, the usual film "boners." It is only when the editor has the picture cut down to about ten reels that the producer and



Selecting the best close-ups for story continuity.

Editing and keeping sound-sync on 4-way synchronizer.

others are called for a final conference on eliminations.

With this pow-wow over, the editor settles down to what is called "fine trimming," for he is working now toward the end of the job. When he has satisfied himself that he has done everything possible, a final dual projection is given to the producer. The track and the picture are run synchronously, but separately, on the same machine, for the composite print is not made until the negative has been approved and conforms to the edited positive print. Then it is sent to the laboratory for processing of release prints.

This job may have taken the editor weeks or months. He has boiled down almost 300,000 feet of film—tracks and picture—to the 8,000 feet of finished picture that you see on the theatre screen. Every scene fits into its place smoothly, as does every sound effect and piece of music. It is said that an editor can make or break a picture. A badly edited film never gets far; but a well-edited film, the work of a highly specialized craftsman, has greatly enhanced box-office value.

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THE STAGE MECHANIC TAKES A BOW

(*Continued from page* 95)

study is given to the operation of the show and changes are made here and there where found necessary. This continues during the run of the show prior to being brought to New York, sometimes for a period of three or four weeks of playing in different cities. The New York theatre in which the show is to open is notified, and the house crew assigned calls the required number of men in each of their respective departments. Very often physical changes must be made to accommodate special equipment. Spotting of lines for hanging pieces, reenforcing, the cutting of traps, etc. In other words, the theatre is put in readiness to receive the production with the specifications and plans which have been sent on ahead.

We have thus seen that the important work performed by the members of IATSE in every stage production justifies the use of the term "Stage Mechanic" to properly characterize their highly specialized contribution to the furthering of dramatic art.

★ ★ ★

PHILOSOPHIC BACKGROUND OF UNIONS

(*Continued from page* 9)

have for lunch, when work should cease, for what reasons and how long employees might absent themselves without losing their jobs, whether payment should be by the day or by the piece, by whom and for what reason a man might be discharged, how promotions and lay-offs should be made.

Modern business enterprises, unlike feudal lords, do not have their own courts, but the control over discharge gave them a rough equivalent.

Wage-earners have sought, through the organization of trade unions, to resist the tendency of property to acquire sovereign or quasi-sovereign powers. Wherever trade unions have sprung up, they have sought to make shop rules a matter of joint determination and their administration a matter of joint control. In other words, in the place of despotism under which the word of the manager is final, unionism seeks to introduce the principle that decisions should be based upon rules and that rules should be based upon the consent of the governed. ★ ★ ★

The S.M.P.E. Salutes the I.A.T.S.E.

By D. E. HYNDMAN
President, S.M.P.E.

THE Society of Motion Picture Engineers for the past thirty years has had through its members the responsibility of designing and constructing all types of equipment and accessories; developing various processes for film, photography, projection room planning, special effects, and studio lighting; and improving film used in the motion picture industry. In addition, the S. M. P. E. has promoted and done much of the origination, study, and finalization of American standards on equipment, processes, dimensional film specifications, performance specifications, data, nomenclature, and the like, that has been a mainspring in promoting economies and efficiencies otherwise unobtainable in the industry. These problems and phases of the motion picture industry are to a very large degree the responsibility of the engineer, the members of the S. M. P. E.

The operation of this equipment each day, the proper use of these special processes for general photography and film, the application of American standards, the test of performance specifications, the practical usage and to a large extent the economies and efficiencies obtained are the direct responsibility of the technicians of the International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators of the United States and Canada. Much could be said about the job well done on the daily tasks assigned to members of the I. A. T. S. E.; however, the weekly theatre attendance in the United States and Canada is the best barometer to judge how well the members of the I. A. T. S. E. and the S. M. P. E. have performed their jobs. American-made motion pictures enjoy the greatest drawing power, the largest box-office take, and the top entertainment value in the world.

For these reasons we of the S. M. P. E. congratulate the I. A. T. S. E. at its 38th biennial convention, marking more than fifty years of service to the entertainment world. Many members of the I. A. T. S. E. are members of the S. M. P. E. and/or vice versa, which brings us close together in cooperation and understanding. Let us continue these principles in unity and with all other interested people that we may continue producing American motion pictures that lead the world for entertainment and box-office values and bring a better understanding of American life to everyone.

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Index to Advertisers

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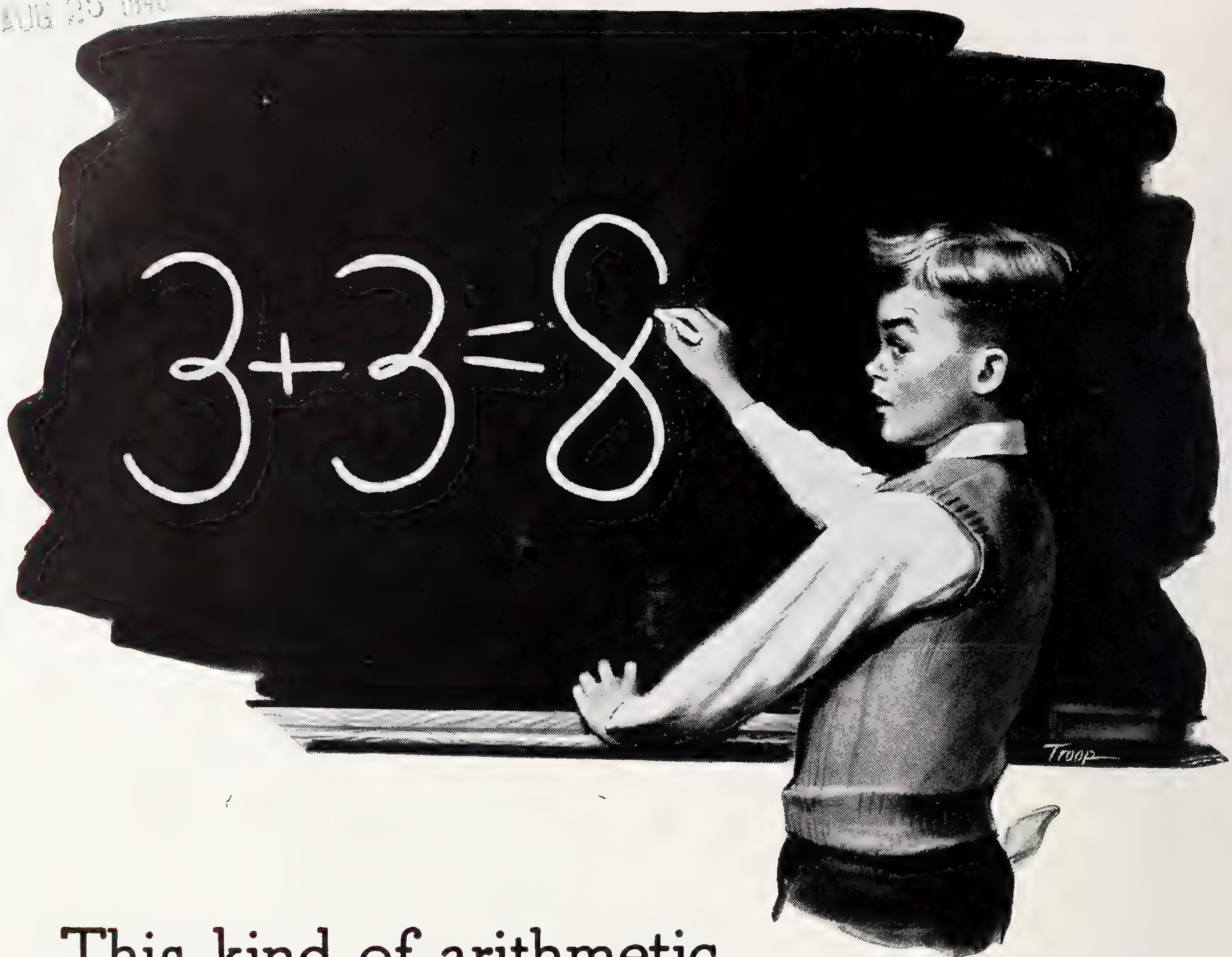

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With Which Is Combined PROJECTION ENGINEERING

HENRY B. SELLWOOD, *Editor*

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MONTHLY CHAT

OF ALL the important floor discuscussions at the recent I. A. Convention in Chicago none was fraught with greater significance to the future security of I. A. members generally, and to projectionists in particular, than that relating to the handling of 16-mm film productions. At Chicago the talk was naturally confined to jurisdictional questions—whether the 16mm field would be organized and directed on a local or a national basis. The local-option boys seem to have carried the day, at least for the present.

But what of the purely technical aspects of this vast 16-mm development? Not a few articles and editorials on this phase of the art have appeared in these pages, wherefrom some good seems to have stemmed, notably in New York, Cleveland, Chicago and on the West Coast. But what of the vast bulk of projectionist organizations which have paid but passing attention (in some cases none at all) to the 16-mm field? We're now talking about—and right out loud—the competency of a majority of projectionists on 16-mm equipment.

Silly, do we hear it said? And shouldn't any professional projectionist who knows his stuff on 35-mm equipment be able to take on any and all types of 16-mm units and do the job going away? The answer is, not at all. The record is replete with instances wherein very competent 35-mm projectionists were assigned to 16-mm jobs and, after many minutes of futile tinkering, have had to ask to be replaced! Harsh words these, and particularly in projectionists' own journal, but necessary nevertheless.

One outstanding 16-mm equipment development of late is the tendency of progressive manufacturers to supplant Mazda light sources with a carbon arc. Eastman Kodak Co., for example, has about readied a new 16-mm projector that will enable the use of both Mazda and carbon arc light sources. This move, to us, is strikingly indicative of what is happening in the 16-mm field, of the need for more and better-quality screen illumination. Very definitely, 16-mm has come of age.

Projection technique must keep abreast of manufacturing developments. The only way to accomplish this job is to do it. Television classes for projectionists are all to the good, but who will assert that the 16-mm situation—with us right this minute—is not deserving of at least as much concern and effort on the part of the craft as is television? This is definitely a craft job, to be done by concerted action by *all* projection units.

For its part, I. P. recognizes its obligation to convey to its readers adequate and authoritative data anent 16-mm equipment and technique. That is why future issues of I. P. will contain a greatly expanded schedule of 16-mm information. Our hope is that this material will be utilized to the very fullest extent.

INTERNATIONAL PROJECTIONIST

VOLUME XXI AUGUST 1946 NUMBER 8

Illusion of Depth in Motion Pictures†

II. Theory and Practice of Lighting for the Camera

By *HOWARD T. SOUTHER*
20TH CENTURY-FOX FILM CORPORATION

If it isn't on the film it can't be shown on the screen, thus the lighting technique employed for the camera is of the utmost importance in creating an illusion of depth in the projected image. Theoretical and practical considerations of lighting so as to achieve a better all-around balance of lighting and modelling are detailed herein.

THE obvious mission of the cameraman is to flatter the senses with an illusion of reality. His secret and true aim is to purvey a psychical effect. The various methods of distortion, whether they be a soft presentation of the image or the sharp transmission of linear optics, all require subjective and stylistic motivation. If initiative and imagination are not used boldly, the camera loses its significance and means of expression. It becomes merely a tool of technique and artisanship.

But here we are faced with a problem. Although we may be artists at heart, we must be technicians in fact, in order that we may employ the technology of our art to paint the soul of the subject. And so the paragraphs which follow will seem intricately and trivially concerned with processes. Yet even miracles must have processes of some kind, however instantaneous.

In a given object, we may concede that the linear and graphic details are inherent in the thing itself. But it is the purpose of proper lighting to mold the dimensions, to transmit the plane, to provide spatial depth, and to give to the picture necessary mood and beauty. Taking into account the laws of optics and photographic transmission, the screen image is a modified light reflection of reality. Light is the main source of photographic construction. Without its primary organizational activity the screen image is impossible.

Photographically speaking, there are two types of lighting, each producing a different visual effect:

(1) Direct, concentrated, or "hard" lighting, which produces a harshly contrasting distribution of light and shade. It reveals sharply the details of the object and the outline of its contours. It transmits the *volume* of the object through linear definition of its perspective. This type of illumination implies lighting from a very intense, single-point source.

(2) Diffused "soft" lighting, which reveals an easy plastic distribution of light and shade. Deep, bright, clear lights are almost entirely absent, while halftones predominate in the image. It suggests space in the form of air—as vaguely plastic, fluid. It is the tool of *aerial* perspective, and tends to pictorial beauty with an evanescent quality. This lighting method implies illumination from a multiple-point light source, each point having a relatively low intensity.

Camera Lighting Plan

The basic idea in lighting for the camera is to cause the object being photographed to register on the film a *different* intensity of light from as many planes of the object as is possible. This plan may be modified by the compositional and emotional requirements of the scenario. The vignette, the silhouette, and the various demands of individual "shot" motivation can make necessary wide deviation from this precept. However, we shall maintain this basic idea because it develops for us the all important necessity of successful motion picture production—*method.*

One of the most important means of accomplishing the cinematic illusion is through lighting our object with the thought in mind that it is a series of planes. These planes are reflecting surfaces. Apparently each surface forms a projecting image when contrasted with a light of different intensity than that of the neighboring surface. Through the progression of a number of these seemingly opposing planes our consciousness builds the illusion on film of the third dimension when reality discloses only two.

Because the head is a commonly accepted subject for photography, and in view of the fact that it contains a complex series of planes, protuberances, and hollows, we shall use this difficult symbol for illustration. The mediums with which we illuminate this subject will be controllable sources of light. Some of these lighting elements will be beams and others will be lamps providing soft broad sources. Usage has given these units various names which are indicative of their function.

The interception of light by an object in everyday life is from above. Our key-

† J. Soc. Mot. Pict. Eng., April 1946.

light simulates the direction of the light source. Usual composition places the object in a position facing the light source, and at an angle of 45 degrees below and around it. The standard lighting set up is shown in Fig. 1. Later we shall take up the use of the other lights shown one by one.

This results in the casting of certain shadows. It is well that we digress for a moment and consider that there are shadows of three general classifications, seen graphically in Fig. 2.

(1) *Primary Shadows*—which are shadows on the object itself, consisting of those portions which receive no light from the source. This is the simplest form of shadow manifestation, but contributes materially to the modeling of the subject.

(2) *Secondary Shadows*—Reference to the figure reveals this shadow to be the one thrown on the background by the interception of the object itself with the light source. This shadow adds to the modeling effect, but is not nearly as important as those of the primary type in achieving an illusion of depth.

(3) *Tertiary Shadows*—which are those caused on the object itself by other objects intervening between itself and the light source. The importance of this shadow varies with the circumstances and form of the intervening objects. In those cases where it may be employed, modeling is materially enhanced. It can be seen that these shadows can be used to relieve a broad expanse illuminated by the key-light and assist in perceiving irregular contour.

Observe in Fig. 3 the phenomenon caused by the key-light of primary and secondary shadows under the eyes, the nose, on the neck, and part of the chin. When employed in this manner, the key-light assumes the following attributes:

(1) It is generally the *hottest* or warmest light.

(2) The key-light simulates the light source.

(3) It is that light which concentrates the attention of the audience.

(4) It determines by its intensity the general *tonal accent* of the composition.

In exteriors, this light might be the actual sun. In some cases this light may impinge from the extreme side angle. Sometimes it may come as a three-quarter back-light. This latter condition will not so clearly reveal the character of the image in a physical way as in an emotional way, after the manner of an effect.

FIGURE 1. ***Standard lighting setup illustrating positioning of the key-light.***

The back-light is placed in some region more or less behind the object. Physical requirements of the element placement in the shot most often require that this light be situated up and out of the range of the lens. At other times, it may be advantageous, under certain set conditions, to hide the back-light directly behind the subject's head. In other cases, it may be necessary to resort to a method known as pseudo back-lighting: the contrast of a brilliant spot on the background with the darker edge of the head area, seen in Fig. 4. This last method can be used when the set placement is such that a back-light can not be positioned upon the subject.

The use of back-lighting presents the linear outline of the image. The contour is sharply defined. Used alone, the frontal plane assumes the character of the silhouette, a dark expanse of low tonal value.

This light is of the unconcentrated type. Fig. 5 will show that its broad, vague-point source serves to eliminate small creases and shadows. It has the effect of flattening out and making less apparent irregularities. An important function of this light is to determine, in a way, the lower limit of the tonal scale in our compositional structure, so far as it concerns exposure. At times, this light is used to establish a "photographic black"—a phrase used to connote a dark tone but not one so definitely underexposed on the film that it assumes a muddy texture.

The more intense the front-light is, the lower the contrast of the picture. We experience a decrease in dynamism but observe an increase in the pictorial quality. In addition, this important light establishes the range of *tonal* gradations. It is very important in determining the elusive factor of quality in the lighting composition.

The length of exposure of the negative also plays a great part in achieving a given tone to the image. By underexposing (shortening the exposure time of the subject) we accomplish a general reduction in tone and a compression of the tonal scale. The image becomes con-

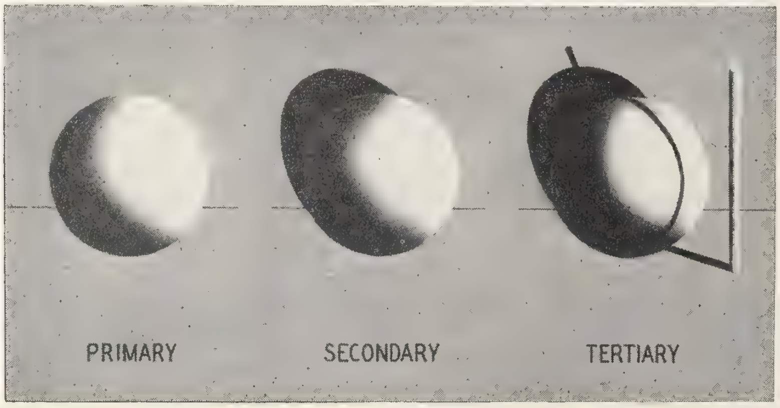


FIGURE 2. ***Diagram showing primary, secondary, and tertiary shadows.***

trasted in nature. By overexposing the image becomes higher in over-all tone value and loses the quality of contrast. The laboratory may control this factor in printing, also.

The name of the light—front-light—denotes its occupational position. It emanates from the region of the camera lens, frontally.

The three lights mentioned above are the most important lights used in the construction of our compositional product. However, there are other lights which are variations of the foregoing. They have functions of lesser importance, but certain conditions of shot construction find them necessary and invaluable.

The 'Kicker' Light

The "kicker" partially assumes the nature of the back-light. It "limns" the object as does the light from which it is derived, but with a much thicker edge. It lines one side of the object only, shown in Fig. 6. Sometimes two of these lights are used, one for each side, as seen in Fig. 7. It can be situated lower than the back-light. Because it is to one side, it may be moved over far enough to escape the camera line. The name of the light is significant. It literally "kicks" the object out of the background, and makes it seem dimensionally forward in the shot.

The thought now presents itself that the camera might be able to photograph the subject from any angle with a given lighting setup. This variation of shooting angle might affect the editorial composition, but pictorially, and from the standpoint of plastic interpretation, the subject should translate itself very satisfactorily to the screen.

This conception involves the necessity for "taking the bull by the horns." Given a starting point for the beginning of the lighting process, it behooves us to light the first unit, set it definitely in its position, adjust its intensity, and then proceed to work completely around the subject until we return to our starting point.

Adhering to our basic precept of achieving a difference of intensity for every plane of the subject, we must at all times bear in mind the following points:

(1) From our study of color we have found that all colors have a difference in actinic quality. Some colors require more light to bring them up to the required exposure level, some require less.

(2) The texture of the material of which the subject is composed may lend itself to a facile or a difficult transmission of light. Inasmuch as exposure depends on light transmission *from the object,* this factor is most important in determining the intensity with which we illuminate that particular area.

(3) The *angle of incidence* of the light has a very decided bearing on the intensity with which it reaches the camera lens by reflection. If the angle of reflection to the lens exactly equals the angle of incidence upon the subject, the transmission is much more effective. This means that the actual intensity of the light upon the subject must be gauged by sight from the lens position. Substances with sheen or polish, therefore, require much more light if these 2 angles do not coincide, and much less if they do. This is shown graphically in Fig. 8.

Water is the most difficult of subjects to light. We may only photograph the halations and reflections on the water or, of course, those things which can be seen through the water. A mirror represents impossibility. We may photograph only those objects which are reflected into the mirror.

In connection with the art of motion pictures, it is well to realize that emotion in the mind of he audience is based on visual sensation. This sensation is a process that has for its foundation the material reality of the actual things, and the human beings, before the camera. The nearer these things are to the camera, the nearer are they to the audience. This closeness promotes a stimulus which is in direct ratio to the size of the image on the screen.

Thus, a close-up of the face offers a prime means of communicating emotion to the audience. Through a near view of the subject, we may observe the *generation* of an idea, the *reaction* to a given occurrence, or the *pictorial qualities* of the idealized form. This last brings us face to face with one of the most important creative problems of the cameraman. It consists in portraying in a closeup of the subject, either the *realized* form or the *idealized* form through the subtle mechanics of lighting.

Idealized Image Form

We shall brook no argument with those who claim that photogenics engender a false or superficial standard of beauty, nor will we agree wholly with those who claim that the subject being photographed must be characterized by a socially or historically significant treatment (the realized form).

It follows that we cannot exclude the possibility of looking at a subject from a certain standpoint with a measure of objectivity even though the illusion of perfection has been the result of, perhaps, an aesthetic formula or recipe. It is perfection for which we strive, and this should result in pictures attaining true beauty. This ephemeral quality we achieve through scientific and realistic

FIGURE 3. ***Shadows which are a resulting phenomenon of the key-light.***

FIG. 4. ***Pseudo back-lighting—the use of a spot on the background to "blow out" head contours.***

FIGURE 5. ***The effect of employing fill-light.***

motivation creatively applied to the camera.

The basis of formal beauty lies in an involved ideological complex. For hundreds of years, since the time of the Greeks, the ideal frontal contour of the human head has been subconsciously accepted as being egg shaped.

It would seem extreme to say that if the head did not assume this egg shape, it could not be beautiful, but we must understand that the concept of facial perfection is not indigenous to a group of people; it is peculiar to the individual. It may not be easily fitted into the vise of uniformity. The monstrous lips of African women charm their men. Cleopatra by present standards is not what one would term attractive. The tyranny of fashion once embraced the "wasp waist" (17th century). The Romans had their noses.

In the pictorial synthesis of the face, the mind unconsciously takes those forms which deviate from the norm and attempts to make them conform in the mind's eye with this accepted ideal of the individual. The less effort entailed in making the subject conform, the more pleasurable is the emotional reaction of the audience. It is the cameraman's duty to promote this rationalizing process on the part of the viewer with every means at his command. These means are based on the phenomenon of optical illusion.

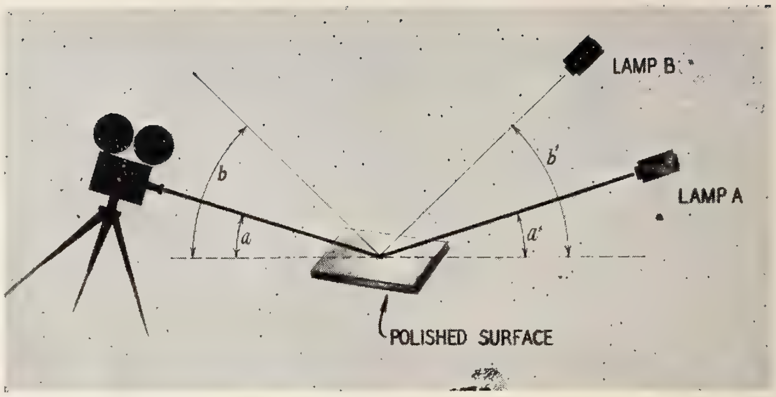


FIGURE 8. ***The effect of light reflection from an object to the camera with changing position.***

Discussion:

Question: The question is asked as to how the monocular method might be used.

Mr. Souther: The paper as presented means to suggest that the "monocular method" is currently employed in the taking of motion pictures, but not to the fullest extent possible. The thought implied by present-day use of the term "stereoscopic perception" includes as a prerequisite for viewing the use of spectacles or a mechanical device to cause a "right-eye picture" to reach the right eye and a "left-eye picture" to reach the left eye, and it was the purpose of this paper to present for consideration the fact that binocular perception by the brain of two disparate views of an object is not altogether necessary in achieving a superior illusion over that commonly obtained today.

The Fuller patents make use of the precepts exposed in this paper—that is, that three-dimensional perception is possible monocularly. Working on this premise, a dual image is imposed on the screen. By placing a line grating in front of the screen, the patent presumes to prevent the eyes or eye from scanning the image and thus duplicating the function which has already been performed by the camera.

Depth Solution Not Distant

This line grating also presumes to prevent the eyes or eye from focusing on the image, thus duplicating another function already performed by the camera. Through the prevention of such duplication, the brain is allowed to perceive normally, through the eyes, the intent of the illusion originated by the camera.

Question: The impression was given that the line-grating process ordinarily used 2 cameras and twin projectors, and that the grating prevented the image of one projector from being seen by both eyes.

Mr. Souther: That is an obvious method of purveying a right-eye image to the right eye, and *vice versa*. However, a complication is involved in that either movement of the head from side to side is necessary or, obviously, movement of the screen from side to side. The line grating as employed, with the intention propounded by the patent previously mentioned, serves a different function, namely that of preventing the eyes from duplicating actions already performed by the camera and thus spoiling the three-dimensional effect.

This is rather an obtuse subject, I must admit. It requires considerable study and undoubtedly will receive a great deal of attention by experimenters in the future. I do feel, however, that the solution is not too far off, although it is not here at the present.

Question: Do we get the same effect in viewing a motion picture with one eye as we do with two eyes?

Mr. Souther: I believe that the three-dimensional effect, observable through the line-grating method we have been discussing, would be increased not more than 50 per cent by viewing it with two eyes, providing the second eye was equally efficient as the first eye during the observation.

In the reel that we have just seen, no special process was used other than an attempt to employ all the possible aids to roundness perception possible with current production methods. In the making of this reel everything was done to include as many foreground objects framing the picture as possible, in order to show one of the important aids to achieving illusion that we can use at present; that is, the relative apparent movement of objects when the camera is in motion.

To answer your question specifically, I do not think that there would be any vastly superior effect in viewing the usual motion picture with two eyes instead of one.

Larger Image, More Depth

Question: I have observed, in viewing Grandeur film, a pronounced increase in three-dimensionality when it was being shown some years ago. Have you any idea why this was so?

Mr. Souther: I believe that the increase in three-dimensional perception in this case was caused by the fact that the usual unnatural angle of the viewer was less pronounced because of the increased image size on the screen. We must realize that today, in viewing a motion picture with an aspect ratio of 3 to 4, we are more violently vio-

(*Continued on page* 29)

FIGURE 6. ***The addition of a camera-left kicker.***

FIGURE 7. ***The effect of adding a camera-right kicker.***

I.A.T.S.E. 38th Biennial Convention

SEVEN hundred ninety-two Locals represented by 1034 delegates having 1075 votes, in addition to several hundred guests, comprised the 38th Biennial Convention of the I.A.T.S.E. held at the Hotel Stevens, Chicago, July 22-26. This most expertly arranged and smooth-running gathering was marked by an almost somnolent calm that extended to and through the nomination and election of officers which saw the "in" administration ticket headed by President Richard F. Walsh returned to office by substantial majorities in every case.

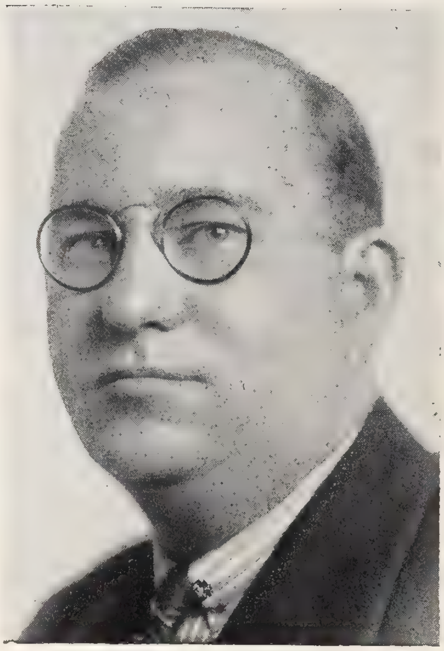
The complete slate of I. A. officers for the next two years appears elsewhere herein, the only change being reflected by the election of Eugene J. Atkinson, business representative of Chicago Local 110, as one of two I. A. delegates to the A. F. of L. convention.

Of outstanding importance was the passage of a resolution, directed at stifling Communist, Nazi and Fascist influence within the I. A., which was widely interpreted as conferring unprecedented executive power upon President Walsh to suspend the operation of any constitutional provision in moving against so-called subversive influences.

So inclusive is this resolution, and so accurately reflective of the almost grim determination of its sponsors, and subsequently the convention itself, to settle definitely the question of subversive influences within the I. A. that the resolution doesn't even bother to define "subversive elements" nor does it place any limitation whatsoever upon the authority of the general office to proceed under its terms as it sees fit. Walsh was quick to announce, however, that "I will not abuse this power."

Important Organization Problems

Chief among the organizational problems discussed at the Convention were the Hollywood studio situation, with especial emphasis being placed on the occurrences therein within the past two years; I. A. control over 16-mm field operations, and preparations looking to preservation of I. A. jurisdictional rights in the television field.



President Richard F. Walsh

Strenuous efforts were made by those particularly interested in the 16-mm field to have all organizational activity vested in a steering group which would operate on a national scale, crossing Local jurisdictional lines, and thus make the I. A. General Office responsible for overseeing the unionization of both production and exhibition of sub-standard film, whether in the industrial, religious or educational field.

This view was hotly contested by the advocates of local handling of the problem, notably by Cleveland Local 160, whose business representative and I. A. vice-president, Harland Holmden, cited the great success attending the efforts of Local 160 over many years in exercising most effective control over 16-mm operations. Other big-local representatives supported Holmden's stand. It was also contended by Holmden that there was no necessity for extending membership to 16-mm projectionists as such, since any "good projectionist" should be able to handle projection equipment using any film size with equal facility.

Those resolutions bearing on the television situation were concerned in the main with seeking to have jurisdiction therefor granted to existing projectionist locals, rather than have direct charters given to straight television groups. These moves stemmed from the chartering in New York City of a straight television workers unit (Local 794).

President Walsh explained that a direct charter was necessitated by the fact that other labor organizations besides the I. A. were contending for these television workers, and that an I. A. promise anent local autonomy and direct representation prior to an NLRB election was a vital, if not controlling, factor in the I. A. victory that resulted.

Television Field Requisites

Commenting on the objection of certain projectionist locals to the granting of separate television charters, Walsh said: "It is at this point that established locals . . . encounter an insurmountable obstacle . . . the lack of knowledge and experience of our members in the work to be performed. . . .

"The cold facts with respect to organizing television studios lead to the inescapable conclusion that . . . it will be advisable to delegate to the General Executive Board and the International President the authority to take any and all

---

President Walsh on 16-mm Field Organizing

"Time and again our local unions have been warned of the expansion of the 16-mm field and have been urged to police their respective jurisdictions. However, many locals appear to have grown indifferent to this new and lucrative field, thus seriously undermining the Alliance's time-consuming and resourceful efforts. . . . This medium of employment holds greater possibilities for our membership than is generally realized . . . and it promises to assume tremendous proportions in this postwar era."

A. F. of L. President Green on Closed-Shop Attack

"Let's analyze this attack on the closed shop agreement. You men here understand quite well the importance of this attack upon closed shop agreements, for if there is any one organization that has developed such agreements which have proved eminently satisfactory to both employer and employees, to a greater degree than any other organization, that organization is yours.

"Was it ever regarded as the violation of any law? . . . Are the workers of the nation to be denied and deprived of the right to negotiate a valid contract for the sale of their labor, and a corporation alone is to have the right to negotiate contracts for making money? Well, the answer of Labor to that question is 'No'; as long as we live we will never permit it!"

Bishop Bernard J. Sheil on Labor-Management Unity

"Labor unions must extend their activities beyond a mere definition of wages and hours and the settlement of isolated grievances. Labor unions ought to participate in the management of industry. This is simply a question of the workers rightful request for a voice in things that affect them vitally. Union-management cooperation is the extension of the principles of democracy into industry; it is an instrument through which all persons in industry participate at all levels in working out their mutual problems. A few outstanding American industries have made a start in this direction."

Sound Recording—1926 Style

SPUTTERING carbon Kleig lights, "masked" microphones that muffled voices, and boom mikes that clattered to the floor from overhead—these were some of the problems that beset the pioneer engineers recording the accompaniment to sound motion pictures 20 years ago. No account of the difficulties encountered in those early days is complete without mention of a church in Camden, N. J. For this church, taken over by RCA Victor for a phonograph recording studio in 1918, is really the "log cabin" of the sound motion picture industry.

The church, scene of the earliest sound film recording, was erected in the late 1880's. Victor purchased it for use as a warehouse, but accidentally discovered its marvelous acoustical properties. The acoustics of the building, an accident in its construction, since nothing was known of recording requirements when the church was erected, made it one of the best recording studios in the world.

One of the first sound films, the sky epic, *Wings*, had all its sound recorded in Camden. When the producers of the picture first outlined their sound problems, it was decided that airplanes themselves were needed to get the proper realistic sound effects. The recording apparatus was moved out to the Camden Airport, a couple of airplanes hired and a large microphone set in the center of the field. But at this point the sound film pioneers ran into trouble. In order to get the roar of the motor loud enough, the planes had to "hedge-hop," or fly dangerously low over the pickup microphone. This meant the sound engineers were forced to record all the plane sequences lying on their stomachs to avoid being struck by the planes' landing gear.

Back in the church studio, these sounds were synchronized with the action in the film which had been "shot" in California, thousands of miles away. In the picture *Lilac Time*, the recording equipment was moved to the U. S. Army Arsenal at Frankford, Philadelphia, where personnel exploded air bombs and fired small cannon and machine guns to achieve the desired sound effect.

But the recording did not always work smoothly. On one occasion a man was hired to operate a wind machine which was supposed to sound like a plane propeller. A second machine, made of light wood slats placed on a revolving ring in a drum, was to simulate machine-gun fire. At the most thrilling moment of the picture, of course, the inevitable happened: the orchestra was playing a very sweet, sentimental background when the sound effects man let go with both wind machine and machine gun. The result on the sound disc was something just this side of bedlam.

Once, while shooting scenes for the picture *Hawaiian Romance*, it was necessary to have real grass in the foreground of one set. But how could they get it? The RCA Victor staff came up with the answer. They spread good Jersey soil over a 20-foot square space in the studio, planted grass seed, and sprinkled it with water. Then they turned the hot Kleig lights on the "acreage" and left them burning all night. The next morning enough grass had grown for the picture-making to proceed. And this was done while, outside the studio, in Camden and along the entire Eastern coast two feet of snow had fallen during the night.

Recording engineers recall many difficulties encountered in the early days of recording for sound pictures. One of the principal problems was effective "masking" or hiding of microphones. The mikes used in those days were big, heavy, and unwieldy. They were taped on the backs of pillars used in scenes, suspended by pulleys from the ceiling, hidden in the bases of potted plants, and generally scattered all over the scenes. Because of their unfavorable locations, the objects used to "mask" the mike would often block the voice pickup; for example, where a mike was taped behind a pillar or back of a chair in a scene, that pillar or chair would often serve as a barrier to good voice pickup, and the result would be a recording that was muffled and hard to understand.

Crude Mike, Light Setup

The boom microphone, suspended overhead and built on a dolly that could be wheeled into the most advantageous position, solved most of this "mike" trouble. But the evolution of the boom mike was not without incident. The first boom mikes were suspended on one end of a cross bar about 10 to 12 feet overhead. These mikes were counter-balanced on the other end by a series of weights, much like those used on scales in old-time grocery stores, but, of course, heavier. Occasionally, while pictures were being made, "grips" would move the mikes too quickly and the weights would come clattering to the floor. The racket would spoil the sound recording, and the cast faced constantly, in addition to the rigors of Kleig lights, primitive camera technique and mike fright, the danger of being struck by the weights and/or the microphone.

Another problem in those days was noise made by the Kleig lights. These lights were of the carbon type, and often their sputtering and fizzing would be picked up by the microphone, ruining the sound sequence. Then too, they would often sputter and shoot the carbon pencil into the air, like a Roman candle.

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(*Continued from page* 10)

action they deem necessary to bring about the organizing of this field."

Sound servicemen, now attached to 140 different I. A. locals, introduced a resolution asking for their organization either into a single national group or into three geographical groups. This request, it was stated, was made so that employer negotiations could be better handled. President Walsh explained that it had always been his policy, even to the contract now in the final stage of negotiation, to call in servicemen representatives when negotiating with the sound companies.

Guest speakers at the Convention included Governor Dwight Green of Illinois, President William Green of the A. F. of L., Eric Johnston, president of Motion Picture Association (producers); Nat Golden of the U. S. Dept. of Commerce and also a member of Cleveland Local 160, Reuben G. Soderstrom, president of the Illinois State Federation of Labor, and the Most Reverend Bernard J. Sheil.

The delegates were unanimous in praising the perfect arrangements and openhanded hospitality of the Chicago Convention Arrangements Committee, the consensus of opinion being that this 38th biennial gathering was the best organized and operated meeting in Alliance history.

Additional Convention details, and particularly those relative to various personalities, are given by Harry Sherman in his "In the Spotlight" department elsewhere herein.

Producer Chief Eric Johnston on Full Production

"In my opinion, the American union today which does not believe in full production is doomed to oblivion as something antisocial. The progressive viewpoint today is one which puts production paramount and condemns the creed of scarcity as something to be dropped down a sinkhole.

"I'd like to see this union and every other union adopt that thought. I say this union particularly, because you and I are partners in the same industry. It is a great industry. It's a unique industry. It has drawn together enlightened, imaginative, adventurous men in all its various branches. This motion picture industry of ours pays the highest wages in all industry. It wants to pay even higher wages. It looks ahead to steady employment—to two things—higher wages and steady employment.

"But both must come out of production. If we on the management end and you on the labor end work hand in glove together, it will assure us all good jobs for all our times. That is, if we work for more and more production. After all, it is not the hourly standard which determines a man's real pay—it's what he produces."

AT YOUR SERVICE

This department is devoted to the man behind the man behind the gun—the serviceman. Its prime purpose is to promote a closer relationship between projectionist and serviceman based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. Contributions from both groups are invited.

A SLIGHTLY defective stabilizer and scanning drum assembly can easily cause side-sway in the film as it passes around the scanning drum, causing sprocket hole noise in the reproduction. By defective, I mean one that is drifting, running ahead and then falling back. This action may be so slow that no "wows" are apparent, yet when this is the case, I believe one is more apt to get the side-sway.

When such trouble is occuring and is due to the stabilizer or scanning drum, it can be readily found by watching the film as it passes over the constant speed sprocket. The film will slowly climb or rise up on the sprocket teeth, as the scanning drum runs ahead; then it will, just as slowly, settle back down on the sprocket, as the drum loses headway. The film, due to the slight warped or buckled condition of all film after a few runs, will seem to waver as it rises and falls, that is, one side will rise or fall first. When this happens, as the film is settling back on the sprocket, one side takes the pull and the film starts running sideways.

These conditions are due to faulty bearings on the scanning drum shaft or to a defective stabilizer. When the shaft bearings are at fault, cleaning and relubricating will clear the trouble. Also, as a temporary measure, threading the film with a fairly tight loop around the drum will help.—W. C. Bowers, *RCA*.

Keeping Service Bulletins Intact

Notebook sheets often pull out if they are not reinforced and often can be reinforced without buying the little paper rings. Put a strip of Scotch tape on each side of the paper, or folded over the top of the sheet. Then punch holes. Not as bulky as regular reinforcement rings and just as strong. Bulletins used by field engineers can be reinforced at the holes to prevent tearing out. — R. H. Hecht, *RCA*.

Hint on Projection Room Vents

Theatres with a vent over the center of the two machines should not have a metal damper closed without it being fused. A good idea is to cover the opening of vent with a sheet of paper in the winter. The first flash of fire will open the vent.—R. H. Hecht, *RCA*.

Correction of Flutter

Severe cases of flutter in Simplex SH-1000 soundheads caused by failure of the stabilizer to come up to speed immediately following changeovers can be eliminated by applying more tension to the upper portion of the pressure roller bracket. This will afford additional pressure between the felt roller and scanning drum. Removal of the locking screw and hinge pin facilitates removal of the coil spring for stretching.

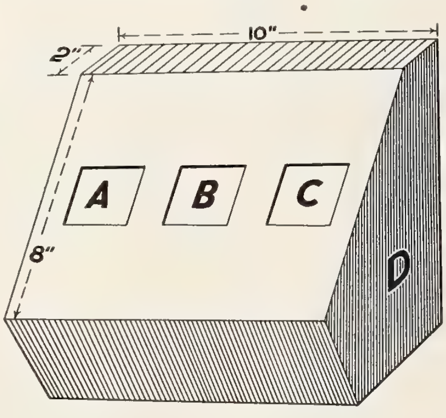
This has been a sure cure for flutter of this type, assuming that the felt roller, stabilizer and pressure roller bearings are in good condition. — C. C. Nagel, *RCA*.

Prolonging Life of M-V Rectifiers

Have found that in many cases new life can be put into 5- and 2-ampere Rectigon bulbs by shaking the mercury down into the bulb and swishing it around, using care not to get any on the filament.—M. W. Gieskieng, *RCA*.

Compact Mounting of Projection Controls Most Used

Monroe Lee and Willie Easley, members of St. Louis Local 143A, have conceived and worked out a novel means for compact mounting of projection controls which are in constant use. This mounting consists of a box with a slanted sur-



face on which are positioned (A) the motor switch; (B) the exciter lamp changeover switch, and (C) the picture changeover switch. Surface D, naturally, angles out from the wall.

The controls are close enough so that both picture and sound changeover can be accomplished with one hand. The setup certainly works nicely. — R. H. Hecht, *RCA*.

Checking Rotary Stabilizer Action

When balancing the output of two soundheads by means of 300-cycle film loops, it is a good idea to turn up the monitor speaker. In this way an excellent check can be made on the action of the rotary stabilizer. If the stabilizer is faulty, "wows" are apparent every time the splice in the loop passes under the pressure roller.—A. L. Friel, *RCA*.

Improving MI-9001 Soundhead

In the operation of MI-9001 Soundheads, smoother starting action may be obtained if rubber blocks, made from rubber heels, are squeezed between the upper part of the motor mounting plate and the soundhead. Some paring and fitting of the blocks is necessary, but the results are well worth it.—W. H. Reasin, *RCA*.

Stability of Power Units

Improved operation of power units may be obtained by soldering the socket shell to its respective connection strap to avoid contact trouble due to screws getting loose.—Iver Grann, *RCA*.

Preventing Soundhead Motor Damage

Projectionists should refrain from checking the action of centrifugal switches or the starting torque of their soundhead motors by holding or braking the motor by hand as it is being turned on. I have found this practice rather prevalent. In holding the motor, very high currents are allowed to flow through the starting switch and starting windings, sometimes fusing the points of the centrifugal switch together and causing excessive drying and cracking of the insulation on the windings.—W. C. Bowers, *RCA*.

Emergency Operation With a Stripped G-248-G

When the G-248-G intermediate shutter shaft gear of the Super Simplex projector is stripped on one end, the gear can be reversed, end for end, on its shaft. Since this shaft has two locking screw holes, it requires very little time to make this change, thus obviating operating on one projector.—G. E. Reiger, *RCA*.

Improved Roller Saves Film

The use of the RCA type pad rollers in W.E. 206-A Reproducer Sets as a part for the lower pad roller arm, has eliminated a source of scratched film since these rollers do not turn freely. The RCA roller does not have the raised section of the roller which rides the film to the inside of the sprocket teeth of the holdback sprocket. As a result, no con-

(*Continued on page* 30)

Basic Radio and Television Course

By *M. BERINSKY E.E.*

MEMBER, INSTITUTE OF RADIO ENGINEERS

XXV—RECEIVING SYSTEMS

IN THE preceding article (I. P. for June) the detector was discussed at some length. The detector is a very important radio circuit because it is capable of receiving a radio signal and separating the audio component from the carrier so that it will be intelligible when fed into a pair of headphones. It was established in the aforementioned article that a detector in itself is really a small radio receiver. You will recall that the crystal detector was also a complete though inexpensive radio receiver, and has been sold as such in the past.

Although detectors are capable of providing reliable radio reception they are seldom used by themselves. A modern receiver is called upon to provide a signal of sufficient output to drive a loudspeaker. Distant reception is also an important requirement. The modern receiver should be able to separate adjacent local stations. A detector acting alone cannot meet these requirements. We can immediately see the need for greater amplification, which means that more than one tube will be required. There are two popular types of receivers which can meet these requirements: the tuned radio frequency receiver (abbreviated T. R. F.) and the superheterodyne receiver.

The T. R. F. receiver consists of one or more stages of radio-frequency (r. f.) amplification, a detector, and several stages of audio amplification. The reader may ask why it is necessary to use one or more stages of r. f. amplification. Loudspeaker reception would be possible without the addition of the r. f. amplifiers, but the results would not be entirely satisfactory.

For local recepion it is not necessary to use a great deal of r. f. amplification because local stations are capable of producing a large amount of current in the aerial-ground circuit of the detector. The detector would rectify this current and separate the audio component from the r. f. carrier. The audio component would then be fed into the audio amplifiers and satisfactory loudspeaker reception would result.

The Regenerative Detector

For distant reception a receiver of such simple design would not give good results unless a regenerative detector were used. The regenerative detector, however, has several disadvantages which restrict its use. We learned that this type of detector is always in an oscillating condition, making tuning difficult and critical, and these oscillations can cause radio interference because the regenerative detector is in reality a low-power transmitter. A modern receiver should not be subject to these shortcomings.

A regenerative detector has the advantage of tremendous amounts of amplification when properly adjusted. When other than regenerative detection is used, additional amplifiers must be used, unless only local reception is desired. When the signal is weak (as in distant reception) it can only cause the flow of small currents which will not properly operate the detector.

The r. f. amplifier increases sensitivity and selectivity and tends to reduce interference by increasing the signal-to-noise ratio. A typical stage of r. f. amplification is shown in Fig. 1. It will be seen that a pentode tube is used in preference to a triode. A pentode has a higher transconductance and lower interelectrode capacitance than a triode, meaning that a pentode will have more gain than a triode.

Because of its lower interelectrode capacitance, the pentode does not require any neutralization, making the circuit simple and stable. The antenna is connected to the primary of the antenna coil, and the ground is connected to the other end of the primary. The incoming signal will set a current flowing in this winding which will induce a voltage in the secondary of the antenna coil. When the variable condenser which is connected across the antenna coil secondary is tuned to resonate at the frequency of the incoming signal, the latter will come in strong (voltage gain at resonance) and signals of other frequencies which reach the antenna will be greatly attenuated.

Because of the attenuation of unwanted signals the r. f. amplifier has a great deal of selectivity. It will be noted that a trimmer condenser is connected across the variable condenser. This trimmer consists of two metal plates separated by a thin sheet of mica. A set screw which can be turned with a screwdriver changes the distance between the plates of the condenser and thus varies its capacitance. Its use will be discussed later.

Untuned R.F. Amplifier

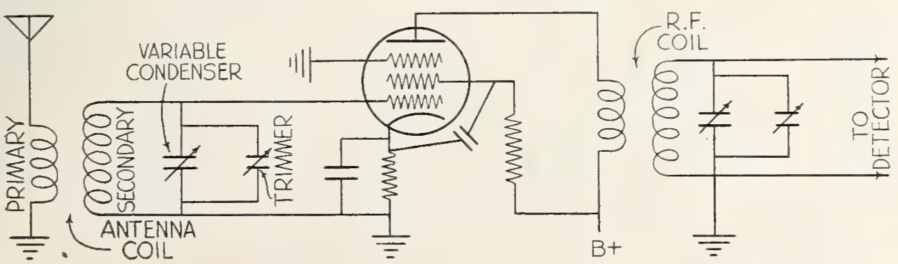
When the station is tuned in by proper adjustment of the variable condenser, the signal voltage increases several times due to the voltage gain at resonance. The signal voltage is then fed into the grid of the pentode r. f. amplifier. The vacuum tube further amplifies the incoming signal, which is then applied to the detector through the r. f. coil. Notice that the screen grid is by-passed to the cathode by means of a condenser which has low reactance at radio frequencies. This prevents radio frequencies from getting into the power supply through the screen-dropping resistor. Negative grid bias is provided by the cathode bias resistor.

The fact that a variable condenser is connected across the secondary winding of the antenna coil means that the stage is tunable and may be adjusted for best reception for any frequency within the L.C. range of the circuit. Such a circuit is known as a tuned radio-frequency amplifier. If the condenser were omitted, the stage would amplify a wide band of frequencies simultaneously. Such a circuit would be known as an untuned radio-frequency amplifier.

Untuned r. f. amplifiers are not selective and do not have as much gain as a tuned r. f. amplifier. For this reason they are seldom used in modern receivers. The signal from the output of the r. f. amplifier is fed into a detector circuit. Any type of detector may be used in this type of receiver, but the plate detector has proved most popular. After the signal is detected it is fed into an audio amplifier and then into a loudspeaker.

It should be noticed that a receiver

FIGURE 1. ***An R. F. amplifier circuit.***



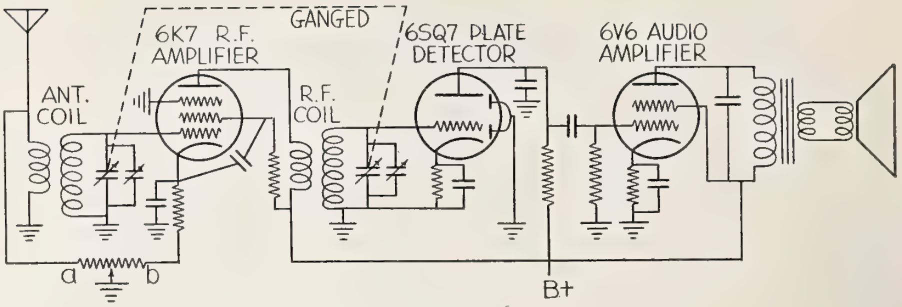


FIGURE 2. ***A complete T. R. F. Receiver.***

which contains one stage of r. f. amplification used two tuned stages, consisting of two r. f. transformers (coils) and two variable condensers. If two stages of r. f. amplification were used, it would be necessary to use three tuned circuits. An increase in the number of tuned r. f. amplifiers will usually result in an increased sensitivity and selectivity and, in general, in better reception.

When several stages of tuned r. f. amplification are used it is necessary that each stage be tuned to the same frequency at the same time. In the early receivers, separate dials were used for each tuned stage. This made tuning difficult and erratic.

In a modern receiver only one tuning dial is used. The variable condensers which connect to the different stages are constructed so that they will turn simultaneously. To do this, the rotors of the variable condensers are placed on a common shaft. In order that resonance be reached at every point on the dial for two or more tuned circuits, it would be necessary to make all condensers exactly alike. All coils would also have to be exactly alike, as would the length of leads to and from the tuned circuits. It is almost impossible to mass-produce radio receivers and component parts to such close tolerances, and even if it were possible to produce receivers to these tolerances, the cost would be prohibitive.

Use of Trimmer Condensers

A much simpler method for accomplishing the desired result is to make use of trimmer condensers. These units are usually mounted on the main tuning condensers. The method of adjustment of these condensers is as follows: a station is tuned in at the high-frequency end of the dial, usually around 1400 KC, and the trimmer condensers are adjusted for maximum signal strength. It is assumed that if the circuits resonate at the high-frequency end of the dial, they will usually resonate at the middle of the dial; at the low-frequency end of the dial, usually around 600 KC, another station is tuned in and the main tuning condenser end plates are bent in or out until the signal strength increases, this procedure being followed for each tuning condenser.

The end plates of the main tuning condenser are usually slotted to facilitate the adjusting procedure. When all of the variable tuning condensers are on the same shaft, they are said to be "ganged." When two or more circuits tune to the same resonant frequency on all points of the dial, we say that the tuned circuits "track."

The coils used in a tuned r. f. receiver will not be considered. In general these will follow the same rules which apply to any other type coils found in radio circuits. They should be designed so as to have a high "Q." Q's from 250 to 350 are very common for broadcast-band coils. In the early types of antenna and r. f. coils, the primary consisted of very few turns of wire, with the secondary containing many more turns. The coils acted like step-up transformers.

In modern receivers the primary usually has more turns than the secondary, and such coils are said to contain high-impedance primary windings. This results in a good impedance match between the antenna and the grid of the first tube. The same applies to the r. f. coil. Here the plate impedance of the r. f. amplifier tube must match the grid-circuit impedance of the detector tube. These coils possess very high gain and efficiency.

A single turn of wire is usually connected to one end of the primary and is then wound around part of the secondary, but it is not connected directly to the secondary winding. This is known as a capacity turn and is usually called a "gimmick" by radio servicemen. The capacity coupling which is introduced by this turn of wire equalizes the gain of the tuned circuit for all parts of the tuning range, resulting in superior performance. Most of the coils used in r. f. circuits have air cores, but in some cases higher Q's are obtainable when powdered iron cores are used.

The coils used in a tuned r. f. receiver must be carefully shielded. If the shielding between coils is inadequate, the lines of magnetic flux which are set up in the detector coil will couple-back a signal to the antenna coil. This means that the circuit would act as an oscillator, and spurious signals would be created. These signals would appear in the loudspeaker in the form of squeals and howls, and the audio output would then be distorted.

Feedback of this type can be prevented by the use of adequate shielding. One way to reduce magnetic coupling between coils is to have a considerable distance between them. This would make the receiver long and bulky. This method was used in some battery receivers of ancient vintage. Another method for reducing feedback between coils is to place them in shields of copper or aluminum. This method was used in many receivers and is still being used.

Still another method is to place the coils at right angles to each other. We will recall that when two wires are placed at right angles the amount of possible induction between them is a minimum. The same is true with respect to coils. This method is cheaper than coil shields and serves the purpose equally well.

In a modern T. R. F. receiver the antenna coil is usually mounted in a vertical position on top of the chassis, and the r. f. coil is mounted in a horizontal position under the chassis. The coils will then be at right angles to each other and the chassis will serve as additional shielding. Short coils of large diameter have a wide magnetic field; while long coils of small diameter have a very narrow magnetic field.

It is common practice at present to use the long coil with small diameter because its field does not extend over a large area. This type of design minimizes the shielding problem.

Complete T.R.F. Receiver

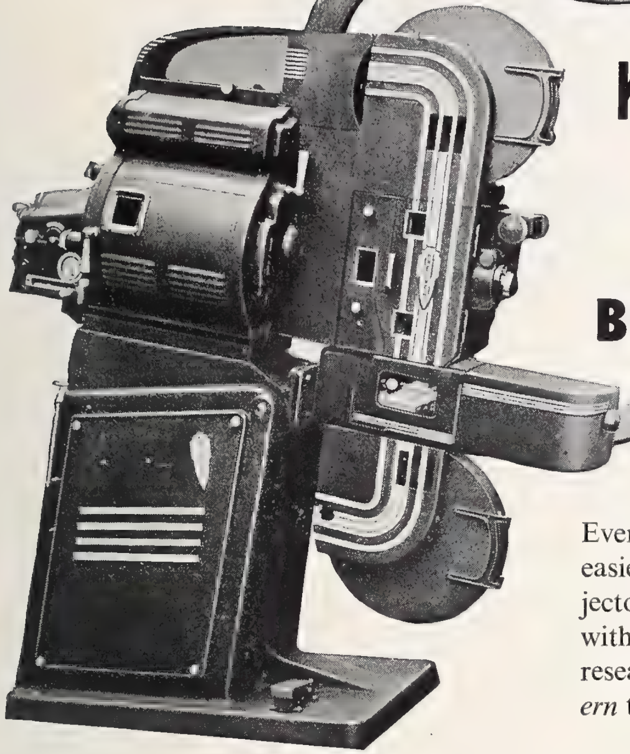
A complete circuit for a tuned r. f. type of receiver is shown in Fig. 2. This circuit is very popular and has been used in commercial receivers for several years. The circuit consists of a 6K7 r. f. amplifier pentode feeding into a 6SQ7 acting as a plate detector. The diode plates of the 6SQ7 are not used in this circuit, so they are tied together and connected to ground. After the signal is detected it is fed into a 6V6 beam-power amplifier which, in turn, is connected to a loudspeaker.

The volume control on this receiver

(*Continued on page* 31)

JUNE QUESTIONS AND ANSWERS

1. **(Q) What is the principal advantage of the grid-leak square law detector?**
   (A) It is very sensitive to weak signals.
2. **(Q) Give the disadvantage of the regenerative detector.**
   (A) It transmits spurious oscillations and is difficult to adjust.
3. **(Q) Why is the diode detector so widely used?**
   (A) It can handle a wide variety of signal strengths without distortion.



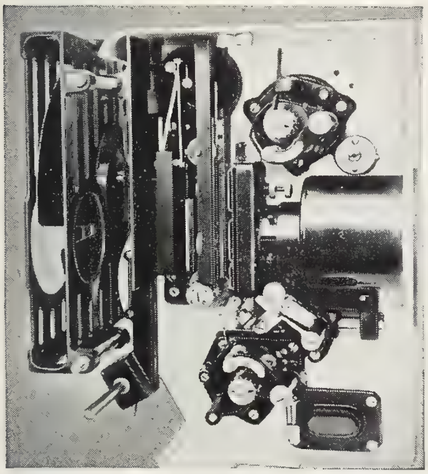
KEEP MODERN THEATRES MODERN with BRENKERT PROJECTORS

Every exhibitor can profit by the dependable performance, easier handling, and longer life of the new Brenkert Projector (Type BX-80). Its many exclusive features . . . tooled with watchpart accuracy . . . represent three decades of research—make it the one-and-only projector for the *modern* theatre.

SIMPLICITY OF OPERATION

EVERY precision-detail of this projector was engineered to simplify operation and provide virtually trouble-free operation.

Exclusive *self-lubricating* system needs little attention—oils entire mechanism properly and continuously *from within*. No oil can be thrown on lens or film to impair the quality of the picture.



Brenkert Projector showing film side with oil-proof and dust-proof features and aperture cooling.

Pre-set microscopic focusing allows removal and replacement of lens *without changing focus*.

All parts are easily removable for quick cleaning and servicing.

Air—silently drawn up through the film trap—automatically cools the picture aperture—and is *vented at top* of projector. Air in lamphouse remains undisturbed, arc not affected.

The secondary aperture for framing enables operator to thread film accurately and quickly.

Adjustable tension on the film gate is provided for the proper projection of all types of film.

For all these—and many other *exclusive* advantages that make for ease of operation, and the finest in projection, use the Brenkert Projector!

Everything for the Theatre

At your RCA Theatre Supply Dealer

RCA—
- Sound Systems
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Brenkert Projectors
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THEATRE EQUIPMENT
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In Canada: RCA VICTOR Company Limited, Montreal

IN THE SPOTLIGHT

By HARRY SHERMAN

THE smoothest running I. A. Convention we ever attended, and that takes in a great many, was the 38th biennial convention held in Chicago last month. To the Chicago Convention Committee we extend our congratulations on as fine a bit of behind-the-scenes management as we have ever witnessed. Everything ran like clock-work. Convention business was carried on without a hitch; diverse means of entertainment was amply provided for the delegates and their families and friends—boat rides around Lake Michigan, tickets for baseball games, sight-seeing tours, theatre tickets, open house at the Committee headquarters where plenty of refreshments were served at all times—the Chicago I. A. locals certainly rolled out the welcome mat.

Larry Cassidy, former president of Chicago Local 2, opened the convention meeting with an introduction of John Pane-Gasser, member of Chicago Local 110 and of the Chicago Opera Company, who gave a beautiful rendition of our national anthem. This was followed by "Oh, Canada" and "Dixie." John was in excellent voice and his singing was truly inspiring.

Gene Atkinson, as chairman of the Convention Committee, was presented with the gavel of authority. He welcomed the delegates to Chicago, receiving an ovation at the end of his brief address. He was followed by the speakers of the day, including William F. Green, president of the A. F. of L., and Eric A. Johnston, president of the Motion Picture Association. The gavel was then turned over to Dick Walsh, who, as permanent chairman of the convention and president of the I. A., appointed the various committees. After reading the report of the Credentials Committee, Walsh adjourned the meeting—thus ended the first day of this memorable 38th I. A. Convention. (Elsewhere in this issue is other Convention data.)

Highlights and Personalities

● The headquarters of Lester B. Isaac, projection supervisor for Loew's, Inc., was a popular spot with the visiting firemen. Lester's parties were the talk of the convention and he certainly outdid himself as host.

● An interesting exhibition was held in the South Room of the Stevens Hotel, where four of the leading projector manufacturers exhibited their machines. Each projector was in charge of a Local 110 member who explained the fine points of the various mechanisms to the hundreds of interested visitors.

William J. Gramer was in charge of the Simplex projector; John Belke for Motiograph; Howard Blackwood for Brenkert, and John Bowman for DeVry. These men were on their toes at all times, each one doing a swell job for the manufacturer he represented.

● The familiar raspy and hoarse voice of Larry Cassidy could be heard at all times. Larry is an old hand at these conventions, his first being the one held in Minneapolis in 1908.

● Bishop Bernard J. Sheil delivered a most inspiring address which was broadcast over a national hook-up. Bishop Sheil made an eloquent plea for the equality of all men and for the true principles of democracy.

● Hugh J. Sedgwick, secretary and business agent for Local 303, Hamilton, Canada, and a delegate from his local, was elected secretary of the 11th District, following the resignation of Arthur Milligan, who held that post for many years.

● The coolest and one of the most popular spots at the Stevens Hotel was the

Seen on the dais at opening session of 38th I. A. Convention: Governor Dwight Green of Illinois; Gene Atkinson, b.a. of Chicago Local 110 and chairman of the Arrangements Committee; President William Green of the A. F. of L.; I. A. President Richard F. Walsh; Reuben G. Soderstrom, president of Illinois Federation of Labor; William A. Lee, vice-president, Chicago Federation of Labor; R. E. Morris, trustee of the I. A., and William P. Raoul, secretary-treasurer of the I. A.

headquarters of the Cleveland Local 160 delegation. Victor Welman and Charlie Bullock were in charge and they spared no effort to make their guests comfortable. Yours truly was not at all loath to take advantage of their generous hospitality.

● The sartorial attire of our good friend, J. Max Ealy, delegate from Local 378, Wichita Falls, Texas, has taken on a subdued note, and we wonder what brought about this change. Ealy, in a high-colored suit and with a happy smile on his face, was a landmark at all I. A. conventions, and seeing him at this last one in somewhat sombre colors worries us no end.

● We were glad to see Mr. and Mrs. Dave Siegel again. Dave, former president of Toronto Local 173 and a delegate to this convention, was keenly interested in all proceedings.

● Harvey Hill and Guy (Pappy) Luther represented Dallas Local 249. Hill, who was accompanied by his wife and son, stuck pretty close to headquarters. Pappy, however, did break loose one night and visited the "Cave," one of Chicago's high spots. It was a tame night for Pappy—no knock-me-downs. Ask him about that suite of rooms he engaged for the Dallas delegates.

● Very much on the scene at the various convention activities was P. A. (Mac) McGuire, International Projector Corp.'s roving ambassador of goodwill. Mac was not only an interested spectator at all the sessions but he also spoke at many district meetings.

P. A. McGuire

Reporting for the Projection Historical Committee, of which he is a member, Mac said that much progress has been made on the projection historical collection which shows conclusively the tremendous contribution projectionists have made to the technical advances of the motion picture industry. He further stated that it is evident that the same high skill of the projectionist, which proved so essential in the past, will be just as necessary with the coming of television and other technical advances in this field. "The motion picture projector," continued Mac, "is a precision instrument from which the best results can be secured only in the hands of the conscientious and competent projectionist—it is not a mere machine."

If our memory serves us correctly, Mac originated the slogan "Better Projection Pays," and for many years he has been pounding home the fact that you cannot get better projection without the best equipment PLUS the skill of the highly trained projectionist.

● One of the many old-timers we had the good fortune to meet again was Dick Johnston of Local 623, West Palm Beach, Fla. This was our first meeting in many years, and we must say that the passing years certainly were kind to Dick—the same genial personality and the same luxurious crop of curly hair.

I. A. ELECTION RESULTS

President	
Richard F. Walsh	649
William T. Bennett	426
1st Vice-Pres.	
Harland Holmden	689
William M. Kemp	386
2nd Vice-Pres.	
William P. Covert	699
John Robert Foster	362
3rd Vice-Pres.	
Floyd M. Billingsley	724
Allan H. Wasson	340
4th Vice-Pres.	
James J. Brennan	715
Thomas H. Brogan	350
5th Vice-Pres.	
Roger M. Kennedy	720
Herbert F. Slater	351
6th Vice-Pres.	
Felix D. Snow	717
John H. Wald	350
7th Vice-Pres.	
Carl C. Cooper	687
George J. Schaffer	377
8th Vice-Pres.	
W. C. Barrett	690
James E. Shaw	364
9th Vice-Pres.	
Louise Wright	667
William Clendenning	398
Sec.-Treas.	
William P. Raoul	644
John A. Shuff	424
Trustees (3 elected)	
George W. Brayfield	719
William C. Scanlan	693
R. E. Morris	673
Homer F. Bowington	363
Grover A. Grider	355
Bernard Willoughby	327
Delegates to A. F. of L. (2 elected)	
Eugene J. Atkinson	715
Thomas V. Green	656
Leo F. Barber	345
Daniel V. Flask	289
Delegate to Dominion Trades & Labor Congress (Canada)	
D. B. Mac Kenzie	705
Robert G. Pollock	312

● The National Carbon headquarters was another popular spot with the delegates. Bill Kunzmann played host to hundreds of visitors and, like yours truly, had a grand time renewing old acquaintances. Charlie Handley, National's technical specialist for the West Coast, assisted Bill and made many new friends for himself and for the company. Erwin R. Geib, head of National's technical specialists group, W. W. Lozier, V. (Jack) Nolan, and Paul Reis were also on hand to meet the boys. These NCC men were kept pretty busy answering the many technical questions fired at them by our men.

● One of the most rabid baseball fans we know is Thad Barrows, president of Boston Local 182. Thad is a Boston Red Sox fan if ever there was one and whenever the team loses a game, it spells heartbreak for him. He had plenty of heartbreak in Chicago, for the Red Sox just couldn't make the grade with the Chicago White Sox and poor Thad had to see them lose two games out of three played. There was some consolation for Thad, however, when he dined with the entire Red Sox team and manager Joe Cronin, a good friend of his, presented him with a baseball autographed by the entire team. Being the good sportsman that he is, Thad knows that his team can't win all the time, even with such a swell player as young Williams.

Thad Barrows

● Pat Offer, delegate from Hollywood Local 165 and its former business agent, took the floor and spoke briefly on the Hollywood situation. Pat and the other delegates from 165, Jim Eddy, Harry Reynolds, and Walter McCormick made a very fine showing.

● We enjoyed meeting again with Frank (Bumps) Coogler, from Houston Local 279. Bumps has an inexhaustible supply of energy that many a younger man might envy.

● Allen B. Smith, National Theatre Supply Co., was very much in evidence glad-handing all his old friends. We understand that Allen cornered the Bromo Seltzer supply for the week. He must have anticipated not a few headaches.

● The Local 407, San Antonio, Texas regulars were on hand. We spotted Mr.

(*Continued on page* 26)

Projectionist's Role in Sound Reproducer Development 1926-46

By FRANK LOVETT
Western Electric Company

THE new era of sound which began with *Don Juan* did not get thoroughly underway until 1927 when the *Jazz Singer* with Al Jolson's classic line, "Mom, you ain't heard nothin' yet," captivated both the industry and the public. The great transition from silent to sound films, with all its attendant revolution and chaos, got quickly underway. Moreover, all of this changed radically the operating procedure, for not only did the step-up from a projection speed of 60 feet a minute to the new sound speed of 90 feet per minute increase mechanical wear disproportionately, but the whole presentation technique increased in complexity.

Where once the projection procedure consisted essentially of threading, lamp care and changeover operations, to these were added the necessity of slow rewinds to protect the delicate sound track, sound changeover, volume adjustment, constant monitoring, and rigid obedience to the cue sheet. In the beginning, unlike the practice of Hollywood today, each reel required a fader setting all its own, and often this setting would require modification in the middle of a reel. In those days the projectionist had, literally, to "sweat out" each sequence.

Silent vs. Sound Projection Requisites

With characteristic resourcefulness, the projectionist strove mightily to master the intricacies of this new art; and as time went on he gathered knowledge the hard way by experience, and soon he was contributing articles on the practical aspects of the art. Before long he not only wielded the factors of electronics as deftly as he formerly did those in the field of mechanics, but his hundreds of practical suggestions enabled the development engineers to create sound mechanisms ideally adapted to the intensely practical considerations of the average motion picture theatre.

Remember such song hits as "Bye Bye Blackbird," "Moonlight on the Ganges," and "Mary Lou"? Most of them received their greatest plugs on the D-86849 "non-sync" set which every old-timer in the projection room will remember.

The W. E. 4-A reproducer, vintage 1928, which gave a new richness to sound reproduction values.

Prior to the introduction of sound pictures projection was primarily concerned with the mechanical arts—the care, adjustment and maintenance of carefully-wrought and intricate gears, cams and shafting. It is true that to a limited extent a basic knowledge of optics and elementary electricity found useful application in the projection room; but many a theatre in a small town had run along for years with a youngster serving as projectionist who considered his stint in the theatre nothing more than a part-time job not deserving of serious study.

Sound pictures changed all this. Almost overnight the projectionist discovered that a background of physics, particularly of electronics, was a prime essential. Such terms as diodes, triodes, pentodes, filters, pec cells, gain, loss, and decibels assumed meaning for him. Acquiring a knowledge of micro-optics and the delicate electro-optical adjustment techniques meant the difference between a successful film presentation and no show at all.

One of the worst things that could happen in the silent days was when a hunk of dirt in the picture gate caused an irregular shadow on the edge of the picture. The flick of a pipe cleaner or toothbrush would fix it. Now, a tiny speck of dust in the slit "gate" of the sound aperture could, and generally did, create a clap of thunder in the auditorium which not only startled the patrons but often sent the projectionist scurrying backstage to replace the blown horn units. Vacuum tubes had a way of suddenly turning white-hot and then failing because of blown filter condensers. Resistors would fail and the grid bias wander off limits. More trouble for the projectionist—and more about the strange new art for him to learn. The weight, size and the need for improved maintenance standards soon dictated improved projection rooms.

The three essential elements of a sound reproducing system were the same in the early days as now: (1) a pickup or reproducer, (2) an amplifier, and (3) a loudspeaker or receiver. The function of the reproducer was

to transform the sound record into electrical energy; that of the amplifier to magnify the infinitesimal electrical energy to the desired value; and that of the loudspeaker to transform this amplified electrical energy into acoustic energy and to distribute the acoustic energy, or sound, throughout the auditorium.

Sound Reproducing Unit Essentials

Of the earliest commercial sound systems the first one reproduced sound from disc; the second reproduced sound from film. The only essential difference between the two systems was in the pick-up apparatus. The disc apparatus was synchronized with the film by means of a mechanical interlock. If the needle jumped the groove, or if a sudden strain cut the film, feverish moments ensued during which projectionists worked to surmount the emergency to the accompaniment of stamping feet in the audience, just as in the earlier silent-film days those stamping feet signalized a film break or a faulty arc.

Early in 1927 three W. E. sound systems were available to the theatre. They consisted of equipment for reproducing sound from disc, sound from film, or a combination of the two. The sound-on-film reproducer employed an exciting lamp which operated through a quartz slit. This quartz slit contained much potential trouble for the projectionist who failed to keep it clean. Coincident with W. E.'s sound-on-film system, new and improved amplifiers—types 41, 42 and 43—were made available. These models had definite superiority over the early 8B, 9A and 10A amplifiers which required external plate supply and batteries or motor generators. The new amplifiers had their own plate supply but still required external "A" battery supply.

Perhaps as great an improvement as any of the early days was the optical scanning system for taking sound from film. This scientific forward step replaced the quartz slit in 1927. Coupled with the new amplifiers, the W. E. system had greater power capacity and delivered more sound in the theatre with far less distortion than before.

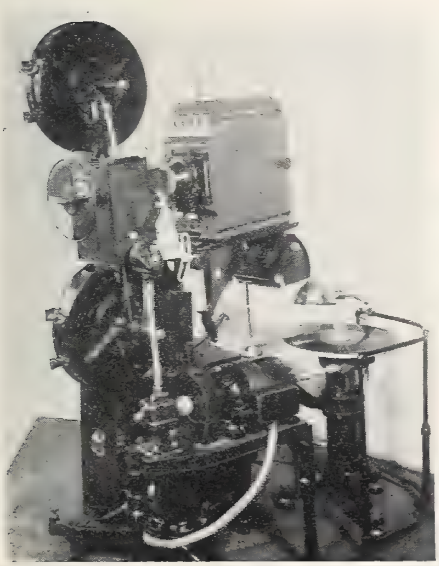
By today's high standards, the first amplifiers were crude affairs, and the slightest knock or jar of the tubes was converted into an electric impulse and transmitted through the system to the loudspeakers where it reproduced as violent noise. To overcome this difficulty, a result of "microphonic" tubes, tube sockets were suspended in sponge rubber from a heavy steel plate which likewise was suspended from a sponge rubber mounting. Projectionists of today who have seen no other amplifying apparatus but that encased in a trim cabinet with one or two control knobs and an indicator, would scarcely recognize the complex array of dials, switches, meters, exposed tubes, pilot lights and push-buttons comprising the main amplifier of 20 years ago.

The same could scarcely be said of the old loudspeakers, for their performance was excellent. Originally the W. E. system utilized a curved horn above the screen and a folded horn below it. These 12A and 13A horns are still in use in some parts of the country. They were the first indoor loudspeakers capable of reproducing music in adequate volume without objectionable distortion. They were a great improvement over the original W. E. public address system which enabled 125,000 people to hear the inauguration of President Harding. Their receiver units were invented just prior to the premier of *Don Juan*. These original exponential horns were eventually superseded by the multi-cellular horn located behind the new perforated screen, giving uniform sound distribution throughout the theatre.

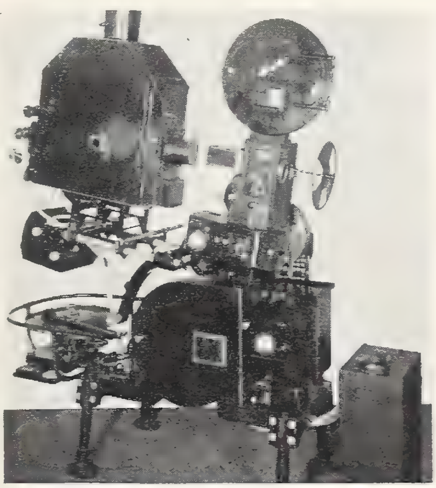
Installation-Servicing Setup

During these early sound-film days a theatre installation-inspection service was inaugurated to minimize service calls. At this same time ERPI established 17 regional projectionist schools throughout the country where thousands of projectionists were taught the technique of sound projection. But all the schools and inspection and all the know-how furnished by ERPI's field men could not anticipate some of the curious events which gummed up the

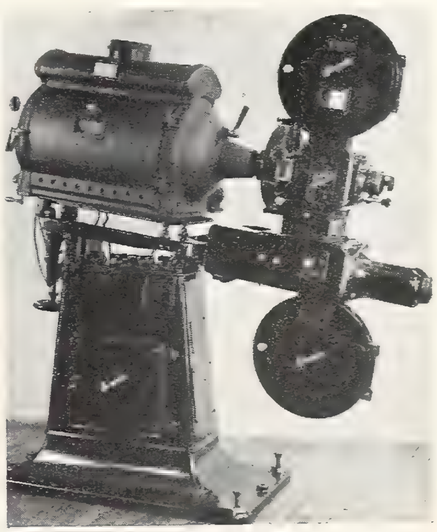
(*Continued on page* 34)



The first W. E. disc reproducer, the model which electrified show business with its reproduction of "Don Juan."



The famous W. E. Universal Base for both film and disc reproduction. Cabinet in foreground is the 7-A motor control box, the so-called "mystery" box for a brief period. Note the Hall & Connolly lamp, which was considered 'tops' in high-intensity projection in those feverish days.



Things really began to hum with the introduction of the TA-7400 reproducer, which was first used for reproducing the sensational earthquake sound sequence in M-G-M's "San Francisco."

TELECASTS

New RCA Tele Equipment Ready

THE first post-war television cameras and other studio and field equipment permitting an immediate start on the long-heralded expansion of television broadcasting, are now in quantity production and some items have already been delivered, RCA has announced. Production emphasis was placed by RCA on the new camera and associated monitoring and relay equipment to provide the essentials for starting now to train personnel and acquire experience, so that program service may be launched as soon as new transmitters become available, now being scheduled for delivery in the Fall.

An outstanding feature of the new camera is its use of the RCA Image Orthicon pickup tube, with light-sensitivity 100 times greater than that of conventional pickup tubes and approaching that of the human eye. Also incorporated in this camera are numerous improvements in circuits and design which grew out of RCA's experience in building more than 4,000 television cameras for military applications.

Whereas prewar telecasting required bright sunlight or brilliant studio lighting, the new camera will pick up scenes by moonlight or candlelight, and in any kind of weather, greatly expanding the field of usable program material. Thus, for the first time, round-the-clock coverage of news, sports and special events is practicable for the television broadcaster, not only adding variety, but also lowering program production costs by making possible a reduction in the schedule of specially prepared studio shows.

The camera can be used for either studio or field pickups. Together with its tripod, it weighs only 100 pounds complete, and the various units—camera, electronic view finder, tripod, and suitcase-type power supply—can be carried separately. They are specially designed for quick set-up and dismantling. A lens turret with four openings, operated by a simple mechanism on the back of the camera, permits the operator to change lenses and refocus in 1½ seconds—an operation that formerly took from 2 to 3 minutes.

A telephoto lens can be quickly attached to one of the turret openings for long shots, and is quickly and easily detached when no longer needed. Used at the Louis-Conn fight at a distance of 235 feet from the center of action, this lens provided an image comparable to that seen by spectators in the tenth row from the ring. The electronic view finder, mounted on top of the camera when in use, enables the operator to see on a fluorescent screen an exact replica of the image he is picking up.

New microwave radio link equipment, consisting of a compact, portable transmitter, which may be mounted on a tripod, and a matching receiver, each equipped with a parabolic reflector and a special hook-shaped wave guide, provides a highly directional wide-band relay link for beaming pictures either from the scene of an event to the studio or from the studio to the broadcast transmitter. Reflectors of two sizes—of 4-foot and 6-foot diameters—will be available.

Signals fed from the transmitter through the special wave guide are amplified thousands of times as they pour back from the end of the "hook" into the bowl-shaped reflector for beaming to the receiving antenna, where a reversal of the process provides a second gain of the same value. With 4-foot reflectors, the signal gain at each point is about 5,000 times, providing an effective over-all gain of 25,000,000 times. If the 6-foot reflectors are used, a signal gain of about 11,500 times is accomplished at both transmitter and receiver, providing an effective total gain of about 132,250,000 times. Under normal conditions, this relay link can be used over distances up to 15 miles.

Complete Portability Attained

This relay equipment is relatively light in weight and can be disassembled into easily portable units. Field setup is merely a matter of connecting the units by means of single plug-in cables and making the necessary adjustments. The transmitter or receiver is housed in a waterproof, cylindrical case at the back of the reflector, and can be quickly removed and replaced with a spare unit if required. The transmitter control is a compact suitcase-type unit with a carrying handle.

Auxiliary equipment consists of a camera control unit with monitoring screen and power supply for each camera to be used, a master control and switching unit with power supply for use when more than one camera is operating, permitting push-button selection of the desired pickup at any time, and a synchronizing generator to provide standard sweep frequencies for the cameras and synchronizing pulses for transmission with the video signal. All are engineered for simplicity of operation and built into portable suitcase-type housings. The synchronizing generator can also be used as part of the test equipment of television receiver manufacturers.

* * *

The high cost of equipment, programming, and production was the deciding factor in 37½% of the withdrawal cases, according to the final figures tabulated by *The Televiser* in a nation-wide survey conducted by that publication. The decision to wait for color, it was indicated, was the deciding factor in only 27½% of the cases. The "breakdown" is as follows:

Withdrawal Factor	*Per Cent*
1. High Cost of Equipment	10.0
2. High Cost of Operation	10.0
3. High Cost of Programming	17.5
4. Waiting for Color Television	27.5
5. Belief "Downstairs" Tele is not ready for commercialization	7.5
6. Waiting for Sets on Market	2.5
7. Uncertainty of Advertising Revenues sufficient to pay Overall Costs	12.5
8. Waiting for Television Networks	5.0 5.0
9. FCC's Requirement of 28 hrs of programming weekly	2.5
10. Complete Confusion	5.0

Interesting to note is the concern of the withdrawal applicants over cost of programming, with 17.5% giving this as the main reason. Of the comments received from withdrawal applicants regarding color, the following is typical:

"After seeing the color demonstration (C.B.S.) it was obvious that once such a station was on the air, there would be substantially no black-and-white receivers sold when color receivers were available."

* * *

CBS' live color demonstrations will begin latter part of August. Color shows heretofore have been from film . . . Pending patents expected to disclose workable system for all-electronic color video . . . Estimated that every 174,000 tele receivers will mean additional million $ jump in power revenue . . . In addition to 9 operating stations, FCC has granted 25 construction permits in 17 of country's top markets.

FCC considered likely to order Paramount to relinquish its 40% holding in DuMont Laboratories, due to rigid FCC rules that no one company may control more than five tele stations . . . Ten of the newest tele permitees are powerful city newspapers . . . Broadcasters to ask FCC for reprieve on full 28-hour weekly schedule after Oct. 31, citing present set shortage as not requiring 4-hour daily programming.

SOUND FILM RECORDING 1926 STYLE

(*Continued from page* 12)

Rosario Bourdon was the pioneer orchestra conductor in sound motion pictures. According to Bourdon, the musical background for Warners' *Don Juan* was recorded at the Manhattan Opera Center, in New York, and the discs that accompanied the film on the first commercial bookings were pressed by Victor in Camden. Musicians had a difficult time dubbing sound on the discs for the silent prints. They had to watch the conductor for tempo and interpretation; they watched the screen to catch the shifting action, and finally, they had to keep an eye peeled on the score in front of them. The result was a sort of optical acrobatics.

Cartoon Scoring Hazards

Bourdon said one of his biggest problems in sound pictures was, strangely enough, the animated cartoons. "Mickey Mouse nearly drove me crazy," he said. He could draw on the standard musical library for mood music in feature pictures and the usual shorts, but the animated cartoons "made straight music sound ludicrous". "There is not much 'mood' music to be found in the library to fit Mickey falling off a ladder, or to accompany a hunter held prisoner up a tree by a skunk, or a shoe being tossed at a meowing cat," he pointed out. "There was nothing left for me to do but to go into the sound effects business."

The method used in the making of orchestrations for the sound pictures was as follows: The silent prints of the films "shot" in Hollywood were shipped to Camden. A projection room was set up in the basement of the church, where the film was screened for Bourdon and the recording engineers. He would mark down the sequences for appropriate musical accompaniment and then call his musicians together for a rehearsal. When ready, the print would then be taken up stairs, screened again, and the musicians would play the necessary accompaniment. When complete, the picture would be played back. Often this first "take" was unsatisfactory, and the orchestra would work late into the night getting the music recorded properly.

Hal Huff Scores in N. Y. Orthoscope Showings

Hal Huff, member of the I. A. Local 150, Los Angeles, and head of Huff's, Inc. (formerly H. & H. Optics) came East following the recent I. A. Convention and staged a series of spectacular demonstrations of his vastly improved Orthoscope lens and other projection accessories. At the same time arrangements were concluded for National Theatre Supply Co. to act as the exclusive distributor for Huff products.

The Orthoscope, which is used as an adjunct to and in addition to the regular projection lens, was demonstrated before a critical audience of technicians and trade press representatives who were unanimous in praising its ability to effect a substantial improvement in screen light not only in terms of quantity but also quality. Very conspicuous was the absence of any "hot spot," despite the greatly increased illumination level, and it was also agreed that the Orthoscope, by reason of effectively highlighting the background, enhanced noticeably the third-dimension effect.

Huff utilized two Simplex E-7 projectors for the test, with factors of print and light being constant. The first test of a black-and-white pattern, run through a split aperture, was followed by the running of a Technicolor print in which the superiority of the Orthoscope was pronounced. A tour of the auditorium revealed the excellent definition and extreme flatness of field achieved by use of the Orthscope.

A detailed technical description of the Orthoscope, the basic principle of which is to converge light rays in straight lines through the lens, will appear in the next issue of I. P. All N.T.S. branches will soon be able to demonstrate the Orthoscope and supply full details thereon.

BUY SAVINGS BONDS

IN THE SPOTLIGHT

(*Continued from page* 21)

and Mrs. Bill Keeler, Manual Ayala, W. R. Tinney, and Mr. and Mrs. John Dennis. The Dennis' had their granddaughter with them—a precocious little beauty of 21 months.

● Murry Smyth, delegate from Local 183, Beaumont, Texas told the writer that this convention would be his last. Murry's health is poor and he wants to sit back a bit and take things easy. He attended his first convention in Chicago in 1915 and wished to wind up his career as a convention delegate in the same city. We have a sneaking suspicion that when the next one rolls around in 1948 our good friend Smyth will once again represent his local.

● Roy Ruben, financial secretary for Detroit Local 199, takes his conventions very seriously. He attended all sessions and gave his undivided attention to each speaker.

● One of the highlights of the week was the search for Jimmy Murtagh's teeth. Jimmy, who was a delegate from Detroit Local 199, had to call in the house dicks to find his teeth, which, strangely enough, were finally located under his bed. Maybe some of the pranksters in Jimmy's hotel room know how they got there, but to date they "ain't talkin."

● Bill Elliott, former I. A. president, installed the elected officials, and made an earnest plea to the assembly for their continued confidence.

● Two of the largest convention delegations entertained each other. The Chicago Local 110 delegates threw a dinner party for the delegates from New York Local 306. The next day the Local 306 men reciprocated and a swell time was had by all present. We hope that a better feeling of friendship was thus cemented between these two locals—the largest projectionist locals in the Alliance.

● Jack Hauser, business agent of Local 96, Worcester, Mass., spoke on several occasions. We were glad to note that Jack has completely recovered from his recent automobile accident and is his old self again.

● Oscar Kleintopf, delegate from St. Louis Local 143, took the floor and thanked the delegates for reopening his case at the 1944 convention, and clearing him of all charges preferred against him. He spoke with deep feeling of his appreciation for their consideration of his case.

● Frank Kinsora, president of Detroit Local 199, told us that the recent campaign to improve sanitary conditions in Detroit projection rooms was inspired by his son, John. Young Kinsora, just out of service, is civic-minded and takes a great interest in the well-being of his fellowmen.

● Convention activities did not prevent Gene Atkinson, business manager for Local 110, from looking after his local's interests. He negotiated a contract during convention week with the United Artists on the showing of the picture, "King Henry V." He signed a contract calling for four men, each man to receive $200 per week. If the picture runs in Chicago for 10 or more weeks, each man will receive a week's vacation with pay.

● In our opinion the finest bit of oratory heard at the convention was the speech made by Thomas A. Reed, business agent for Washington, D. C. Local 224, in nominating Wm. T. Bennett for the presidency.

● Many of the delegates were deeply moved when Robert E. Shuff, delegate from Local 267, Tiffin, Ohio, nominated his father, John Shuff, business agent for Akron Local 364, for the office of

secretary-treasurer of the I. A. We believe that this was the first time a son nominated his father for high office in the Alliance.

● Cal Bornkessel and Floyd Spencer, representing Rochester Local 253, were in excellent spirits, and why shouldn't they be? These two men were elated over their success in obtaining extra pay for their members working on holidays. Eventually, we believe all I. A. men will receive extra compensation for Sunday and holiday work—as in other industries.

● Fred Matthews, delegate from Local 301, New Britain, Conn., meet Fred Matthews, president of Motiograph. If these two Matthews haven't met before, they may consider this a formal introduction.

● Hank Leslie, president of Vancouver Local 348, introduced us to former president R. G. Pollock and J. R. Foster, Local 348 delegates. We are very much impressed with our Canadian brothers, and would like some day to make a tour of their I. A. locals.

● I. A. representative Al Johnstone and Emile Beaud, both of New Orleans Local 293, were two of the busiest guys at the convention. They spent most of their time with the 7th District delegates and were busy hopping around from one meeting to another.

● H. Paul Shay, 10th District secretary and delegate from Local 289, Elmira, N. Y., failed to make good the dinner he owes us on a bet. We won't hold it against him this time, however, knowing how tied up he was with convention business, but this is to serve notice on him that future dinner bets will be collected —come hell or high water.

● For the first time in many years we met again with Walter Hudson, delegate from Local 225, Atlanta, Ga. With him was Jake Pries, business agent of the local, who was accompanied by his son, Ralph, manager of National Theatre Supply Co.'s Philadelphia branch. We remember young Pries when he was just a toddler, and seeing him after so many years made us feel like Methuselah.

● Anthony Discavage, representing Local 218, Pottsville, Penna., was another serious-minded delegate. We need more of these quiet men who go about their daily tasks without any fanfare, but who add immeasurably to the prestige of the craft.

● St. Louis Local 143 was represented by delegates Harry Barco, business agent of the local, Oscar Kleintopf and Earl Rafferty. Mrs. Rafferty accompanied her husband and together they make a fine looking couple on the dance floor.

We had a very interesting chat with Barco, who impressed us with his deep interest in the welfare of his men.

● The TMA (Theatrical Mutual Association of the United States and Canada) is making a strong bid for new members. This worthy organization has been in existence since 1883 and is the forerunner of all organized fraternal associations

among the mechanical workers in the amusement field. Representing the TMA at the convention were Grand President Phillip Hitter and Charlie Eichhorn, members of New York Local 306, Grand Secretary-Treasurer Frank Galluzzo, Chicago Local 110, Charlie Ring, Cincinnati Local 327, Willie Noon, New York Local 1, Jim Marksbury, Sioux City Local 355, Charlie Mueller and Nate Stein.

● I. P. wishes to thank the many delegates who showered us with congratulations on our special I. A. Convention Edition, and thanks also to our readers who have sent us written expressions of their appreciation of our efforts to bring to the attention of the industry at large the many and varied crafts that comprise our great Alliance. We regret that the paper situation did not permit us to use all the material we had planned for this edition.

● Frank Powderly, delegate from New York Local 1, was taken ill the opening session and it was feared at first that he would have to be rushed to the hospital. He quickly rallied, however, and was back in action the very next day.

● President Walsh's report on the Hollywood situation was a masterpiece, in the opinion of the majority of the delegates present. He talked extemporaneously for one hour and twenty-five minutes, and held the attention of every man present.

● Hal Huff, member of Los Angeles Local 150, brought some of his projection gadgets along with him to demonstrate to the boys—among them a negative carbon alignment, air chute, deflector glass, and orthoscope lens. These are but a few of the projection accessories he is sponsoring.

Although we were pretty skeptical of Hull's claims for his orthoscope lens, we accepted his invitation to attend a demonstration which was held in a New York theatre for National Theatre Supply Co. personnel. All of Huff's claims for his lens were substantiated to the satsifaction of those who witnessed the demonstration. As one observer exclaimed, "Amazing! It increases the light on the screen by at least 15 to 20%!" Keep your eyes on this Huff guy—he is a practical projectionist with ideas that really work.

● That plucky guy, Charlie Brunner, was on the scene again. Charlie was reelected secretary of the 4th District.

● "Smiling" Frank Walker, delegate from Local 236, Birmingham, Ala., had a great time recalling certain incidents we thought had long been forgotten. Joining him in ribbing sessions was Ralph Root, also a member of the Birmingham local. Like the proverbial elephant, these Southerners have long memories.

● In charge of the 10th District headquarters was Bert Ryde, business agent of Buffalo Local 233. Bert not only was the official greeter for the District but he also took a hand at dish washing when the supply of clean glasses ran low.

● Fred Newcomb, secretary of District No. 3, was secretary of the Resolutions Committee, a post he has held for many, many years. In the old days, we could hear Fred's booming voice reading the proposed resolutions without the aid of a microphone—it was powerful enough to reach every corner of the auditorium.

● Nat Golden, member of Cleveland Local 160 and chief of the Motion Picture Division of the Department of Commerce, delivered an important address in which he stressed the increasingly important role the projectionist is called upon to play in the industry.

● We were glad to meet the delegates from Local 299, Winnipeg, Canada—Jim Biggerstaff and Ed Turner.

● Ben Pinzel, president of Buffalo Local 233, came to the convention with his wife and son, Donald, who is still in uniform. The Pinzels are mighty proud of their offspring, introducing him to all the delegates. Much of their time was spent in the company of the Casey MacDougals of Cleveland Local 27.

● Bert Steinhauser of Terre Haute Local 373 and the writer have at least one topic of common interest—and that is the ingratitude of man. There are some of us who do appreciate kindness and consideration—but, unfortunately, these are in the minority.

● Jim Gorman, president of Chicago Local 110, was here, there, and everywhere, doing more than his share.

ILLUSION OF DEPTH IN MOTION PICTURES

(*Continued from page 8*)

lating our visual continuity by confining the angle of view. We place ourselves in the theatre in what would appear to be a long black tunnel, and view a scene transpiring in what would seem to be an opening at the end of this tunnel. Certainly this is something we are not used to in every day life, and calls for a particular type of accommodation on the part of the viewer which must result in some irritation.

I believe that this irritation reduces, unconsciously, the viewer's ability to perceive solidity. I would say that in my opinion the larger Grandeur screen, because it does not limit the angle of view so much, gives a greater three-dimensional effect, but only for that reason.

QUESTION: Could we have that reel run again? I would like to ask the members to confine their observation to the screen with one eye this time. I would also suggest that the members make a viewing tube out of their hands in order to exclude observation of the rest of the room. The purpose of this is to see if an increase in the three-dimensional effect is caused by such viewing.

[*Ed. Note.*—The film was re-run, and a show of hands was called for to indicate whether an increase in solidity had resulted from this observation with one eye and through the exclusion of the room in the field of view through the viewing "hole" formed by the hand. The show of hands indicated that approximately 80 per cent of the members present had experienced an increase in the feeling of three-dimensionality.]

QUESTION: Can we have the film run once more, and this time ask the members to cover one eye only and view the film without the tube formed by their hand?

[*Ed. Note.*—When the film was run, a show of hands was called for as to whether the effect was more pronounced or less pronounced than in the last test. Approximately 75 per cent of the members believed that there was less effect than before. The film was then run once more upon request, and viewed again with both eyes.]

QUESTION: How is the intensity of the key-light controlled on the actor's face, particularly in a "two-shot"?

MR. SOUTHER: If I understand your question properly, I would say that the intensity of the key-light on an actor's face is determined by tests before the start of the production. The reflectiveness of certain make-ups differs, and the addition or decrease of key-light for a certain make-up must be predetermined. For all normal scenes thereafter throughout the picture the key-light intensity is adjusted to this same tested level.

This presupposes the use of a controlled standardized development process, such as that employed by 20th Century-Fox. It is not unusual to have an entire day's shooting print on a single light setting. Where two actors, both using make-ups of different reflectiveness, are illuminated by a single key-light, scrims must be employed on that side of the lamp to adjust the particular make-up to the degree of light transmission determined upon by tests before the start of the production.

It was pointed out during the demonstration that the use of dimmers on incandescent units calls for judgment in the choice of the power of the illumination unit. A unit too large, dimmed to the required intensity for a close subject, results in illumination of poor spectral quality, which in printing causes muddy texture owing to its low actinic value. The proper regulation of arcs, when used as key-lights, calls for extreme care in placement of the illuminating unit and the precise application of scrims to control intensity. Dimmers are not currently practical on arcs.

Set Telefilm Speed Record

A new speed record for Telefilm Control efficiency was claimed by cameramen and track stewards the other day. Within nine minutes after running of a horse race at Suffolk Downs, Boston, judges had ruled against a foul claim by a jockey. The 16-mm films were collected, developed and dried, shown on the screen and the stewards made their decision in less than nine minutes.

AT YOUR SERVICE

(*Continued from page* 14)

tact is made with the film and no scratches can occur on the soundtrack section of the film.—D. W. McMillin, *RCA.*

W.E. 303-C Transformer Data

The 303-C transformers in W. E. 42 and 46 amplifiers have two separate windings in each section, the two being connected together at the center terminal. By unsoldering the wires from the center terminal, the two windings can be used separately or they can be paralleled for greater current handling capacity.—B. D. Douglass, *RCA.*

Testing Exciter Lamp Current

In order to quickly make a series circuit with an ammeter for checking lamp current, I slip a small piece of film between the bottom lamp holder contact post and socket contact strip. Film works out better than cardboard or paper, since the latter often tears.—R. H. Bisbee, *RCA.*

Lettering Lacquer

A bottle of finger nail lacquer makes a handy source of paint for lettering or numbering around the projection room where only a small job is being done. It contains a brush and after the paint is used, the bottle can assume its usual role of container for film cement. Use the lacquer for painting a strip across the end of each pad roller and then it is easy to tell at a glance whether or not the rollers are turning.—B. D. Douglass, *RCA.*

Projection Film Reels

Projectionists using the various types of reels that are held together by screws or bolts through the hub should watch them closely, as a loose screw can work out while the reel is turning and stop the reel by catching in the magazine.—B. D. Douglass, *RCA.*

Making the MI-1715 Fader More Accessible

Punching out the bottom of the MI-1715 fader box, it is possible to clean the bottom contacts of the switch more readily than by trying to do it from in front. A piece of metal put in the bottom of the box keeps out the dust.—Alfred Kunze, *RCA.*

Improving 211-242 Tube Contacts

Twenty-two calibre shorts put over the tube prongs in the case of the 211 tube in the 43 amplifier and you won't have to rebuild the lead contacts anymore. Faulty contacts ages the tube very fast, so that in doing this, you also get more out of the tube. Not a new idea, but it works fine.—Alfred Kunze, *RCA.*

Repair Suggestions

Have found that a screwdriver that had been ground to almost an icepick point was a good tool for removing the wire retaining ring that holds the rubber motor mounting rings in place. A projectionist suggested the following: purchase a rubber, such as used on a crutch, and place same on a hammer which, in turn, would serve more like a mallet and wouldn't mar or be as apt to damage equipment.—J. P. Geiger, *RCA.*

Tele Engineers Put Color Video Five Years in Future

The color vs. black and white controversy has completely confused the industry. Prospective tele applicants are divided as to whether to wait for color or go into black-and-white now. Set manufacturers, with the exception of a few of the leaders, are stalling just as long as they possibly can. Advertising and agency men admit that they have no idea what it's all about. CBS, Zenith and Federal make one claim. RCA, DuMont, Philco and others make counter claims.

The function of a trade publication is to clarify such muddled situations. To do this, we went to one of the few independent groups in the industry—consulting radio engineers—a group which should be qualified to pass judgment on this controversy. We asked their opinion on how soon they believed commercial color television would be technically and economically feasible—the time element involved before UHF color television could get into operation.

Wide Difference of Opinion

35 questionnaires were sent to consulting engineers throughout the country. 29 answered—7 placed color televion from 6 to 10 years away. 12 estimated the time element at five years. 7 thought color would be in operation within two years. Three would not make any commitments as to time. An average of the 26 replies on the time element puts color television five years away.—Television.

BASIC RADIO AND TELE

(*Continued from page* 18)

is of somewhat unusual design, and the theory of its operation will be given so that the reader will be able to recognize it when looking at commercial receiver diagrams. Suppose that it were desired to control the gain of the 6K7 r. f. amplifier. This could be accomplished in several ways. One method is to control the grid bias on the tube. We can do this by inserting a variable resistor in the cathode circuit of the tube.

If the resistance be increased, the negative bias on the grid will increase while the gain of the tube will decrease. When the resistance is decreased, the gain of the tube will increase because the negative bias on the grid is decreased.

Another method for controlling the gain of a stage is to vary the gain of the incoming signal. Suppose that a variable resistor were connected across the primary of the antenna coil. When maximum resistance is connected across the primary, little effect will be observed, because the resistance is high compared with the impedance of the primary and the resistor will not have any noticeable effect on the signal. When the resistance is decreased it has a tendency to shunt away to ground some of the signal which normally would go to the primary of the coil. This will cause the volume to decrease.

In Fig. 2 a combination of the two methods just explained is used. When the variable arm of the volume control is moved towards point *f* the resistance in the cathode circuit will decrease and the negative grid bias will also decrease. This will increase the gain of the tube, and at the same time place more resistance across the antenna coil primary, which will also increase the gain. When the arm is moved towards point *a* the negative bias on the tube is increased and the gain of the tube is decreased. At the same time, less resistance is placed across the antenna coil primary, and this will also tend to reduce the gain of the stage.

The T. R. F. receiver usually has very good tone quality, but this is due to the fact that it has poor selectivity and cannot separate weak stations that are very close on the dial. The receiver can be made more selective by increasing the number of tuned stages, but this would add to the expense of the unit. A modern T. R. F. set rarely has more than two such stages. The superheterodyne has proved to be greatly superior to the T. R. F. for all-around performance, thus very few T. R. F. receivers have been made during the past eight years.

AUGUST QUESTIONS

1. Why should magnetic coupling between coils be prevented?

2. Why are tuning condensers ganged?

3. Why is a pentode better than a triode as an R. F. amplifier?

The answers to these questions will appear in the next issue.

Presenting: Bert Bell of Oklahoma

INNUMERABLE show business personages have been "born in a theatre" but that's not the way it was with Bert Bell from out Oklahoma City way. Bert insists that "show business was born in me"—which is somewhat of a new twist. Anyhow Bert Bell and the theatre have been practically synonymous terms for 40 years.

Bert is another recruit from the aisle-pounders corps, having been an usher when only 14 years old. At 16 years of age Bert was touring with a tent show of the so-called dramatic-rep' variety. Motion pictures caught up with him in 1907 when he ran his first picture machine, an Edison model, in a 5-cent nickelodeon. Cranking the machine, feeding the lamp, and changing records on a "graphophone" (used for ballyhoo) all day long for 7 days each week was the routine—100 hours work for $15.

In 1912 Bert started with the Folly Theatre Interstate vaudeville circuit on what was a comparatively cinch job: 2 shows daily requiring about 7 minutes of pictures at the opening, with maybe a spotlight being used now and then. This type of show, Bert avers, marked the beginning of the close association between actors and technicians that has existed ever since.

Bert went I. A. in 1911, joining Local 112 as an apprentice and serving 3 years as such. He was instrumental in organizing Local 380 in 1915, was its first business representative, has held all offices therein since, including B. A. for last ten years. He also represents Local B-59.

Extensive Labor Activities

In the broader labor field Bert served 6 years as a v.p. of the Oklahoma State Federation of Labor, a year as organizer for the Oklahoma City Trade Council, plus a volunteer A. F. of L. organizer for the past ten years. He has also been Secretary-Treasurer of I. A. District 15, comprising Oklahoma and Arkansas. August 9 last marked Bert's 18th year on the same projection job. No, the accompanying picture of Bert as a youth was taken a bit earlier than 18 years ago and does not show his present working quarters.

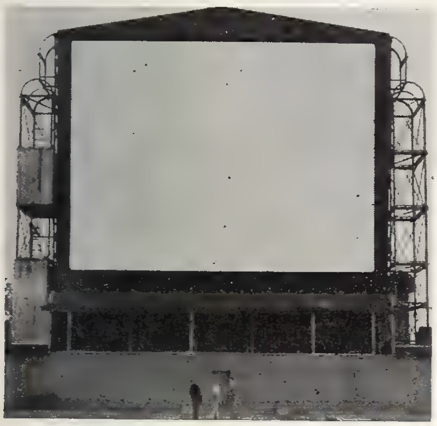
Overall, Bert still finds time to teach a Sunday school class for 14-year-old boys and to be quite active in the Masonic orders that he belongs to. He is also a member of the I.O.O.F., of the Variety Clubs and, Bert brags, of the 25-30 Club of Greater New York. The loudest-ringing Bell is, however, an official designation as Ambassador of Good Will for Oklahoma City.

Last December 22 marked Bert's 55th birthday, thus his show-business career encompasses the period of the art's greatest development. He doesn't pretend to know it all, or even a major portion thereof; in fact, he thinks he still might be induced to look for a "film stretcher." But in common with many old-timers Bert merely says, "Show business has been darned good to me and I wouldn't take a different tack if I had it to do over again."

Bert Bell and his 1912 projection setup. (Such hair!)

62x45 Ft. Screen in New Drive-In

Movies on the largest outdoor motion picture screen in the world are now being viewed by thousands of Rochester (N. Y.) drive-in theatergoers. The theater's giant screen, 62 feet wide and 45 feet high, is made up of a series of all-steel panels evenly spaced at relative distances



Comparison of mammoth screen with group standing before it.

apart to lessen the effect of wind and accommodate warping from exposure to the elements. Constructed on two 250-ton sunken concrete bases, the huge screen is capable of withstanding extremely high velocity winds.

Built into a 75-foot structure, the screen is plainly visible to a 1,250-car audience. Fourteen ramps accommodate 850 automobiles, with "standing room" for an additional 400. A novel innovation of the $100,000 project is the 1,200-square-foot balcony, located below the screen, where patrons may dance before and between performances. Currently, an amplifier system provides the sound effects. When available, individual speakers will be installed for each automobile.

Other outstanding characteristics of the new theatre are a glass brick marquee lighted in full color, and a $30,000 projection installation which includes two Simplex E-7's, two Peerless Hycandescent lamps, and two new Super Cinephor f/2 lenses working through an f/2.2 condenser system. The arc pulls 160 amperes, using super-high carbons.

Simple, Lightweight 16-mm Projector Aim of Schools

WHY can't we have a simple lightweight projector? asks Paul V. Mulligan, director of visual education for Revere, Mass., schools, in a communication to *Educational Screen* that has pertinence to all users of 16-mm equipment. The weight and mechanical features of projectors are factors which must be considered when we talk of convenience, continues Mr. Mulligan, who adds:

The setting up of a projector is another matter. It takes 15 or 20 minutes to remove a projector from its case, set it up, arrange the screen and thread the machine. The 50 or 60 pounds weight is also a problem. Even the most enthusiastic projector salesman will admit that all projectors are heavy. It is no joke to juggle one of these machines around. Remember that in the armed services they had good strong young fellows setting up these machines and doing the projection. That's all they did; the instructor did all the teaching.

It seems to me . . . the problem goes back to the manufacturers. We need a light machine which is very simple to operate. When I say "simple" I don't mean what the manufacturer's literature tells you about simplicity. I mean simple.

The projector should sell for one-half or one-third the price of present projectors. There are at least 20 companies that manufactured projection equipment for the armed services. It seems reasonable that one of them would find it profitable to attack this problem.

Some manufacturer has a chance to do a great deed . . . and also to capture a vast market. We need a Henry Ford in the projector manufacturing business. We need a light serviceable machine . . . simple to operate . . . a kind of "Jeep" projector. It will eliminate the need for a combination longshoreman and engineer in order to use the equipment.

PROJECTIONIST'S ROLE IN SOUND REPRODUCER DEVELOPMENT, 1926-46

(*Continued from page* 23)

works and marred the Main Street premieres of many sound pictures.

The servicing routine was punctuated by many humorous incidents. A Maryland theatre got about eight yards "out of sync" during a serious picture. The troubleshooter arrived in time to adjust the interlocking device but the exhibitor would not permit interference. The serious picture had turned into such a thoroughly enjoyable comedy that the management was afraid the audience would resent correction of the apparatus.

A prize story concerns the technician who rowed eight miles across flood waters to answer a service call from a small Kentucky theatre. The projectionist had checked everything but the motor-control box. As the Erpi man proceeded to that task, a mouse zipped across his hand. In the next few minutes he had removed her eight babies from the nest which had been built in defiance of the laws of electronics and the high artistic purpose of Hollywood's most aesthetic stars.

An improvement of great importance to sound pictures in the early days was the Universal Base projector which enabled reproduction of sound either from disc or film independently of the other. The Universal Base was followed by the 211-type system and the de luxe 7400, or Mirrophonic, system. At this time Western went to the 86- and 87-type amplifiers which were capable of delivering 50 watts. By comparison, New York's world-famous Roxy theatre had opened years before with only 6 watts! In those days 6 watts was considered high power. Simultaneously, Western introduced the new di-phonic speaker system which was an outgrowth of the famous Fletcher loudspeaker system. This new system contained two elements, one for reproduction of low- and the other for reproduction of high-frequencies, the so-called "tweeter" and "woofer."

We note in passing that these loudspeakers led to the Battle Announcing systems used by our Navy in World War II. The small high-powered amplifiers led to the Beach Master and similar systems, whose giant voices were powered by as much as 2000 watts and saw service on every fighting front.

Non-Projection Sound Problems

One service performed by the early sound-film projectionists is now almost forgotten. That was the patient cooperation they rendered acoustical experts charged with the responsibility of eliminating slap-back echoes and the strange effects produced by sound equipment when first installed in the 1920's. Who can fail to recall the rear-wall echo, when sound heard directly from the screen reiterated itself in a fraction of a second? The horns had to be re-directed. In some cases the echo was eliminated by application of acoustical material to the walls; in others, devices had to be constructed to obviate the effect of tricky theatre domes. Whole ceilings had to be specially treated, and at times backstage draping of a costly nature had to be utilized.

All of these problems were met and solved. In each of them the projectionist played an active and indispensable role. W. E. engineers had commenced their sound picture development work in 1912 and required fourteen years of research, interrupted only by World War I, to provide the disc apparatus which introduced *Don Juan*. However, other apparatus for recording and reproducing sound from film, later to be a factor in the career of the projectionist, had already been accomplished in the Bell Telephone Labs, formerly the W. E. engineering laboratory. This new apparatus was introduced in 1927.

Invaluable Aid by Projectionists

As one by one these laboratory accomplishments were translated into practical equipment for the use of the industry, projectionists assisted the engineers with suggestions which facilitated their practical application. The development and practical introduction of Noiseless and Wide Range recording by W. E. made further demands on the talents of the projectionist.

In 1937, when the motion picture industry had weathered the depression and passed through stabilizing adjustments, Erpi ceased supplying sound equipment to domestic theatres and, instead, licensed others to manufacture such equipment. At that time the theatre servicing functions of Erpi in the U. S. were sold to a group of its employees who formed Altec Service Corp. In 1941 Erpi was merged into and became a division of Western Electic. The Erpi Division continues to carry on its licensing functions and remains active in the sound recording equipment field. It maintains a laboratory in Hollywood for carrying on engineering and design of recording equipment furnished to studios, calling upon the Bell Laboratories for fundamental development.

★ ★ ★

Philosophic Background of Unions

By SUMNER H. SCHLICHTER, Ph. D.

QUITE a large number of labor unions—notably the machinists, the electricians, the sheet metal workers, the boilermakers, the blacksmiths, the carmen, the printing pressmen, the photo-engravers, and the clothing workers—have demonstrated not only their willingness to cooperate with managements in solving problems of operation but their ability to make an important contribution.

Needless to say, these organizations are not willing to cooperate on *any* terms or conditions. Naturally and properly, they put the interests of their members ahead of the interests of the stockholders for whom they work. The fact remains, however, that ingenious and far-sighted leaders on both sides who possess the will to cooperate have succeeded in discovering a basis on which management and labor can join to promote the interests which they have in common.

Whether or not the dominant note in American industrial relations during the next generation will be union-management cooperation or bitter class-struggle depends upon the leaders on both sides. My prediction is that the policy of union-management cooperation will prevail, because I am confident that there is enough industrial statesmanship among American business men for them to realize that the policy of suppressing organization is the policy of sitting upon a safety valve.

★ ★ ★

Guessing can be expensive

Guessing can be expensive at any time but particularly so today with the present limitations on new projection room equipment and with the uncertainties of replacements. Every projectionist should know the whys and wherefores of his equipment. He should know what to do and what not to do when the equipment fails to function properly—and how to keep the show going until the service inspector arrives at the theatre.

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INTERNATIONAL PROJECTIONIST

SEPTEMBER 1946

VOLUME 21 • NUMBER 9

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INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

HENRY B. SELLWOOD, *Editor*

Volume 21 SEPTEMBER 1946 *Number* 9

Published Monthly by

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MONTHLY CHAT

THE magazine *Television* accurately reflects the fretful state of mind of broadcasting company executives in the appended script for unions' participation in the video field:

"Television's future will be closely linked with union activity. The unions are now jockeying among themselves for control—using their positions in radio, motion pictures and the stage as opening wedges for their entry into television. No one will deny that unions are an integral part of our American economy. But everyone hopes that the jurisdictional disputes which have already started will not be allowed to grow to a point where television is stopped once again.

"Formulation of policy on hours, wages, and job classifications are part of labor-management relationships. But unnecessary work stoppages to determine which union should do the bargaining is a wasteful expenditure of both labor's and capital's productive capacity.

"While we are on unions—one of the worst crimes that a union can perpetrate on its members is to paint a false picture of an industry's need for their services. They close their eyes to the fact that new developments can make obsolete a job; that technique and economics are allied, and all the shotgun weddings in the world cannot prevent divorce. How much better it would be if the unions, through education, honestly assayed the workers' importance in an industry, and then if they weigh short, direct their energies to new fields. . . ."

I. P. will endorse the foregoing—provided there be some foreseeable end to the seemingly interminable "experimental" period of video during which only "qualified staff engineering personnel" may be used; also, that the fellows now undergoing "on-the-job" training under the G.I. Bill of Rights (Uncle Sam pays the tab while the broadcasters pay practically nix) will someday "graduate" to the level of a full-pay worker.

The broadcasting field today is thoroughly unionized, right down to the so-called disc jockeys, but those old lush earnings still pop up year after year. Why should television be different?

• • •

Nowhere in the reams of copy spilled incident to the 20th anniversary of the commercialization of sound pictures was there any mention of the projectionist forces who contributed so mightily to the success of this enterprise. Here is our favorite yarn in this connection:

At the premiere performance of Vitaphone 20 years ago, Sam Warner, now unhappily deceased, visited the Warner (Broadway, N. Y. City) projection room and told the crew: "Boys, everything depends upon you from now on out. Put it over—and I'll pay you the three weeks overtime I owe you." The boys collected.

INTERNATIONAL PROJECTIONIST

VOLUME XXI SEPTEMBER 1946 NUMBER 9

First Publication Anywhere

The Forest Electronic Arc Lamp

By J. K. ELDERKIN
Forest Manufacturing Corporation

THE production of maximum light and its proper distribution over the surface of the motion picture screen is, as all projectionists know, dependent upon the efficient functioning of every unit in the visual projection chain, whether mechanical or optical. Considering the fact that even the slightest variation in arc gap will occasion a radical change in the character of the projected image, it is obvious how interdependent are the various elements that constitute the projection process.

The great improvement wrought in projection optics during the past few years, plus the impending change in the design of several well-known projectors which will enable the use of larger-diameter and more efficient lenses, constitute a major contribution to the solution of the optical phase of the two-sided problem of enhancing the projected image.

But, mindful of the old adage that a chain is no stronger than its weakest link, it is obvious that better optics cannot alone effect sufficient improvement in the projection process to accomplish any substantial advance in the art. The mechanical phase must advance apace.

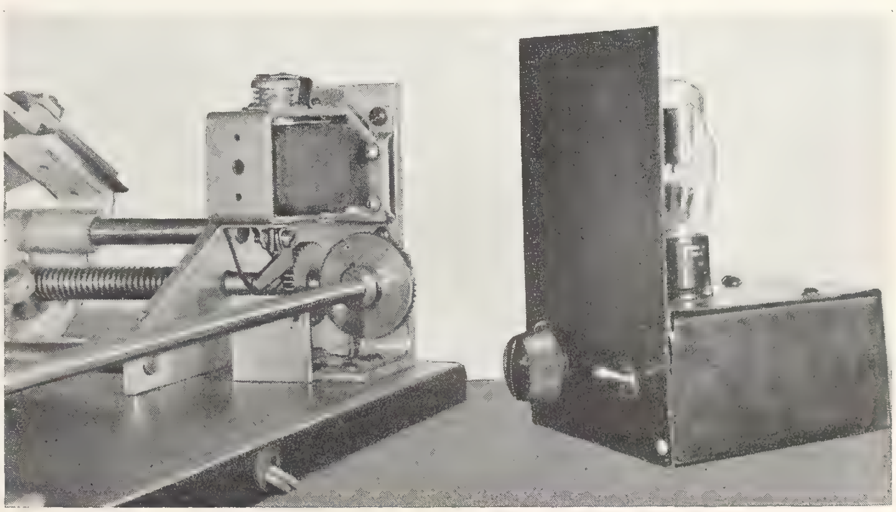
The present wholly mechanical system of feeding the positive and negative carbons in projection arc lamps is obsolete. Modern science, the beneficiary of an accelerated wartime pace, has provided us with a means of arc control that is more accurate, more reliable and therefore more productive of a better end result than any mechanical system that ever has been or likely can be devised—an electronic arc control.

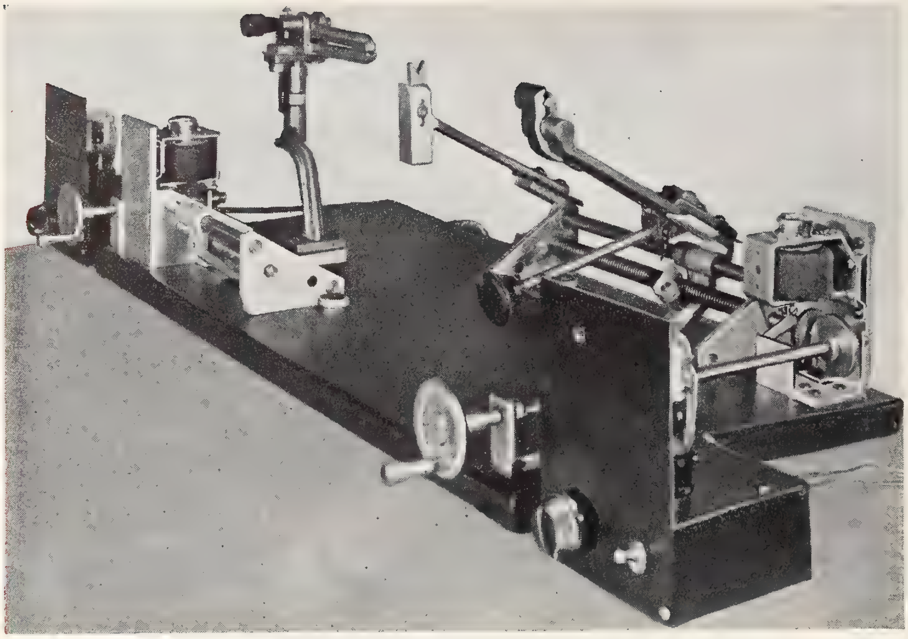
The mechanical means presently employed for carbon arc feed in projection lamps consists of two feed screws, one driving the positive carbon carrier and the other driving the negative carbon carrier. These two feed screws are driven through gearing and clutches by a single motor and a speed-reduction gear.

Either a cam mechanism or a pawl-and-ratchet arrangement is provided to regulate the speed of the carbon feed. Carbon consumption depends upon the amperage at the arc. The *ratio* of carbon consumption varies with the amperage at the arc, thus it is of the utmost importance to utilize a system capable of *precise* carbon feed in order to maintain the proper focal point necessary for producing maximum light intensity.

Since present mechanical feed systems operate from a single driving source, it is impossible to maintain the carbons in correct focus for any appreciable period of time. If the positive carbon is feeding too fast and an adjustment is made to alter its speed, the speed of the negative carbon is affected. Very slight changes in current or voltage of the arc occasion

Close-up view of the ratchet wheel, pawl and solenoid of the Forest Electronic Arc Control. To the right is shown the electronic generator which supplies impulses to the solenoid.





Stripped-down view of the Forest electronic lamp base showing the positive and the negative mechanisms and the 2 electronic generators, one at each end of the base. The reflector and its holder are removed to show the mechanism more clearly. The electronic generators are fitted into the back of the lamp, being shown in this detached position for illustrative purposes only. The positive and the negative control knobs are placed in convenient operational positions on the side of the lamp.

a change in motor speed, thus causing the feed mechanism to run either too slow or too fast.

Maintaining the correct arc gap at present requires almost constant attention by the projectionist, and even then it is almost impossible with existing control systems to maintain the arc at its critical focal point.

Improved Control Requisites

The correction of the inherent faults of present carbon arc feeds can be accomplished by satisfying the following requirements:

1. Separate mechanisms for both positive and negative carbon feeds, completely divorced from each other.
2. The driving means must be one the operating speed of which will not be affected by changes of the current supplying same.
3. Each of the feed mechanisms, positive and negative, must have an independent driving means so that their individual speeds of travel may be regulated at will.
4. The elimination of cams, clutches, gears and all associated gadgets.

A mechanism reflecting considerable research and ingenuity has been developed which successfully meets the aforementioned requirements. The Forest Electronic Arc Control * operates in the following manner:

The positive carbon feeding unit consists of two slide rods which support the carbon carrier, and a worm screw suitably attached to the carbon carrier in such a manner that when the screw is rotated the carrier is fed toward the negative carbon. The slide rods and the worm screw are supported in the usual manner by end plates or bearings.

The feed screw protrudes through the end of one of these supports and has secured directly to it a ratchet gear. This gear is rotated by a co-acting pawl actuated by a solenoid magnet in such a manner that each time the plunger of the solenoid moves in a forward direction the pawl turns the ratchet gear a *predetermined* distance.

For instance, in the case of a ratchet gear having 30 teeth and a solenoid to rotate it at the rate of one tooth for each solenoid movement, it is apparent that 30 solenoid strokes per minute will revolve the worm screw one revolution per minute. Therefore, if the worm screw has, say, 8 threads per inch, the carbon carrier will be moved forward ⅛ inch. It follows, then, that 60 solenoid strokes per minute will move the carbon carriage forward ¼ inch per minute.

Electronic Impulse Generator

It will readily be seen that by the proper selection of worm screw pitch and ratchet gear teeth, in conjunction with the number of electronic impulses supplied to the solenoid coil, any feeding speed desired may be obtained. There remains, therefore, only the need to supply sufficient electrical impulses to the solenoid to drive the mechanism at the desired speed.

An electronic device was designed whereby the regular 110-volt A.C. supply line is converted into impulses which are fed to the solenoid coil. This device, an electronic impulse generator, is extremely simple and compact and has but a single control knob with which to vary the number of impulses supplied from 20 to 120 per minute—a speed range for the feed mechanism which is much lower and much higher than is ever required.

Production of impulses by the electronic control is regulated as accurately as is an electric clock. A graduated dial at the control knob is marked for amperage so that the feeding speed can be set at the exact point required by the arc current. A very slight adjustment of this knob will regulate the feed exactly to suit a given condition; that is, as the arc current varies slightly the control may be set to the average condition and will thereafter maintain the arc at the exact focal point.

The negative feed mechanism is exactly the same as the positive mechanism, with a separate electronic impulse generator controlling the speed of the negative feed. There being no mechanical or electrical tie-up between the positive and the negative feeds, each feed may be adjusted wholly independent of the other, and any size or any combination of carbons may be used.

This Forest electronic system utilizes no reduction gears, no clutches and no fast-moving parts, thus reducing frictional wear to a minimum. If the carbon holders are fed up to their extreme limit, they merely stop without occasioning any injury whatsoeevr to the mechanism. A manual control for both positive and negative feed mechanisms is brought out on the side of the lamp.

The electronic arc control which is the outstanding feature of this new lamp has already been demonstrated in stripped-down form to scores of engineers, manufacturers and projectionists.

[Ed.'s Note: Editorial and diagrammatic material relative to the circuit for this electronic control will appear in the next issue of I. P.]

* Patent pending.

Ampro 2"x2" Slide Projector

A new 2" x 2" slide projector embodying many new operating features has been announced by Ampro Corp. Easier, faster operation is emphasized, the result of a new automatic snap-action, self-centering slide changer which assures instantaneous hairline focus, perfect screen alignment, and the interchanging of glass and ready-mounts without refocusing. Other features include an $f/3.5$ lens of 5-inch focal length, new condenser design, and a pointer aperture to permit use of pointer with slides.

DeVry Names 2 Distributors

DeVry Corp. has appointed two new distributors for theatre equipment: McCarthy Theatre Supply Co., Fargo, N. D. for the Dakotas, and Garwin Theatre Supply Co. for Cleveland and surrounding territory.

RCA's New Blue-Sensitive Phototube†

By J. D. PHYFE
RADIO CORPORATION OF AMERICA

A new phototube designed to provide optimum performance when used in reproducers having standard black-and-white silver sound tracks, or with color films having either dye or edge-treated sound tracks, has been developed by RCA as a result of the rapidly increasing color footage now being used. Some results of laboratory tests and field observations when this new tube is substituted for the standard red-sensitive 868-type phototube are detailed herein.

NEED has recently arisen for a phototube that could be interchanged with the type commonly used in theater soundheads. The necessity is the result of an apparent trend toward an increasing use of color in motion picture film productions. Also, there is the possibility that a larger percentage of these color films will have dye sound tracks instead of the usual silver tracks. The desired tube should be interchangeable with the red-sensitive type, therefore, and must perform as well when used with films that have the regular silver sound tracks.

Such a phototube has been developed in anticipation of these needs, and is known commercially as the type 1P37. To date the observed performance of this tube indicates that it accommodates this changeover very well. Mechanically and electrically the *1P37* is interchangeable with the type *868* phototube which has been used in RCA theater sound equipment for more than a decade.

In order to evaluate the merit of this new blue-sensitive phototube for theater use, comparisons of performance have been made in the laboratory with the type *868* red-sensitive tube. In addition a number of the blue-sensitive phototubes have recently been distributed to various theaters throughout the country with instructions to use them in place of the *868* tube, and report their relative behavior.

Too short a time has elapsed since these phototubes were placed in the field for observation, so reports on performance are not complete at present. Laboratory tests have been made, however, to determine how well they would function in theater soundheads with standard release prints, and if there were any adverse operating characteristics which might preclude their being substituted for the *868* tube. Some of the characteristics investigated were:

EXCITER LAMP VOLTS A.C.	OUTPUT WITH 1000 CYCLE FILM		HUM OUTPUT		HUM OUTPUT BELOW 1000 CYCLE FILM OUTPUT	
	IP37	868	IP37	868	IP37	868
7.5	17.7	19.1	-0.4	-3.4	18.1	22.5
8.0	20.0	20.4	+2.0	-1.6	18.0	22.0
8.5	21.8	21.8	+3.8	-0.2	18.0	22.0
9.0	23.3	22.7	+5.7	+1.1	17.6	21.6
9.5	24.8	23.8	+7.4	+2.6	17.4	21.2
10.	26.5	24.9	+10.0	+4.0	16.5	20.9

FIGURE 1. Relative film and hum output variations in db—*IP37* versus *868*. Film removed for hum output measurements.

(1) Relative gain as compared to the *868* tube when used with films having the usual silver sound tracks.

(2) Relative hiss level and microphonics.

(3) Ionization or glow point.

(4) Relative distortion.

(5) Relative hum level when used with raw (unfiltered) a-c on the exciter lamp.

(6) Gain variation with changes in exciter lamp brilliancy owing to line voltage fluctuations.

(7) Ease of balancing output between sound heads by varying the anode voltage.

(8) Frequency response relative to the *868* tube.

(9) Refocusing of the optical system because of different spectral sensitivities of blue-sensitive and red-sensitive phototubes when interchanged.

Results of Laboratory Tests

The results of these tests are reported in the order enumerated previously:

(1) *Gain Check.*—This was made by running a 1000-cycle loop of standard silver sound track through a regular theater soundhead and amplifier channel, and noting the levels. Both types of phototubes were used. A sufficient number of both types were checked to represent an average cross section of sensitivity variation. Exciter lamp and phototube anode voltages were held constant at $8\frac{1}{2}$ and 75 v, respectively.

Results of this check showed that the sensitivity of the two types of phototubes is practically the same, with a slight superiority of the *1P37* tube. It was noted that the *1P37* tube showed somewhat less variation in output from one tube to another than tube *868*.

(2) *Hiss Level and Microphonics.*—This test was made by checking the relative outputs of a group of red-sensitive and blue-sensitive phototubes using a 1000-cycle film loop as a signal source. The film was then removed, the amplifier gain was raised to approximately 130 db and the hiss level was measured. The hiss level was checked both on an output meter and a sound-level meter used in conjunction with a standard 2-way theater loudspeaker system.

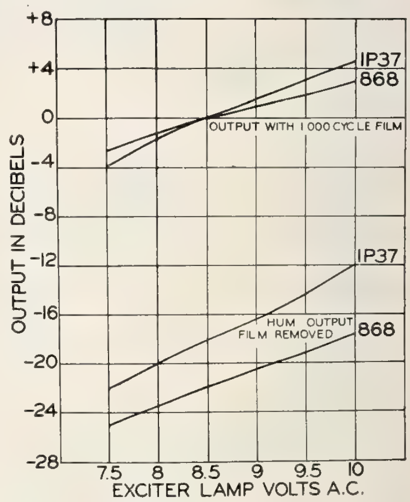


FIGURE 2. Relative signal-to-hum response.

Microphonics was then checked by starting the projector motor and noting the output level, as was done in measuring hiss. The results of these tests revealed no apparent difference in hiss or microphonics when the blue-sensitive phototube was used.

(3) *Ionization or Glow Point.*—No changes in voltage supply are necessary when changing from the type *868* phototube to the *1P37* type. The same maximum supply voltage limitations exist for both types.

(4) *Distortion.*—A constant-frequency film having 80 per cent modulation was run through a standard theater soundhead and theater amplifier channel using both types of phototubes, and the r.m.s. harmonic distortion measured by means of a distortion factor meter. The measured distortion was found identical for the *1P37* tube and the *868*.

(5) *Relative Hum Level.* — Using a.c. on the filament of a standard 10-v, 7.5-amp exciter lamp, the *1P37* tube showed 4 db more hum when the exciter

† J. Soc. Mot. Pict. Eng., May 1946.

Chickens Home to Roost

EXHIBITOR paper advertising representatives have long striven assiduously to minimize the importance of the projectionist as a vital factor in the flow of equipment from factory to theatre—the while the editorial staffs exert frenetic efforts to sit astride the fence and develop some measure of justification for such advertising by including "projection data" in their general equipment sections. The futility of this policy is vividly illustrated by the appended excerpt from a recent editorial in the equipment section of a leading exhibitor magazine. Witness:

> It was our pleasure . . . to attend the Convention of the Allied Theatre Owners of New Jersey at Atlantic City last month (June).
>
> It is our discomfiture to report that insofar as the equipment exhibition was concerned, the convention ran true to form. Meager attention was given the too few exhibits which had been set up for the attention of the delegates—every one of whom should be extremely interested at this time in knowing what the market provides in the way of new theatre equipment.
>
> We were asked again and again, and indeed we would like to know, why motion picture exhibitors are such a poor audience to the industry that makes it possible for them to operate and profitably maintain their places of business.
>
> In this particular instance, a sizable exhibition hall was provided, through which the delegates had to pass in order to attend the sessions. The convention was exceptionally well attended, the entertainment was good and the prizes (donated by suppliers) were plentiful. Gin rummy games were rife, even during the speaking sessions.
>
> In fact, everyone got a swell break but the equipment and material manufacturers who toiled and sweated to set up and tear down their equipment, which a relatively few theatreowners took the time and trouble to look at and hear about. . . .

Such naivete! The foregoing merely confirms that which I. P. has long known: Mr. Exhibitor, following the industry pattern of watering the leaves and neglecting the roots, always has been, is and likely always will be, projection-wise, a technical bum who initiates mighty few purchases of projection equipment. He simply buys what he's told to buy by projectionists and other technicians—the group which is really responsible for the excellence of present movie reproduction.

If it weren't for the latter group the projection room still would be as much out of mind as it is out of sight and would still contain taped moving parts, cracked reflectors, worn parts and a generally horrific equipment plant.

But the Chicago I. A. Convention equipment show was vastly different from the Atlantic City exhibitor meeting. At Chicago the equipment people really got a run for their money from fellows who know and care about what they're doing—the same fellows who spend their own dough for their own publication and contribute their own time, often after quitting work around midnight, to attend technical sessions.

Of course, those exhibitor papers that dabble in projection matters really aren't so naive as their advertising solicitors make them out to be. One such paper recenlty ran a *full-page* ad which cited the receipt of one—we said *one*—subscription from a *projectionist.*

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lamp voltage was adjusted to a normal operating value of 8.5 v. This was based on equal signal outputs for both types of phototubes using a 1000-cycle film loop. Figs. 1 and 2 show relative signal output and hum levels between the *1P37* tube and the *868* when the exciter lamp voltage was varied between 7.5 and 10 v. Hum level was measured by removing the film after output measurements were taken.

Gain Variation Increase

(6) *Gain Variation with Changes in Exciter Lamp Voltage.*—Referring to Figs. 1 and 2, a gain change of 5.8 db is observed for the *868* phototube and 8.8 db for the *1P37* tube, using a 1000-cycle film. This shows a 3-db increase in gain variation for the *1P37* tube when the exciter lamp voltage is varied between 7.5 and 10 v.

(7) *Balancing Sound Head Outputs by Adjusting Anode Potential of Phototube.*—The adjustments used for balance of the sound head outputs are the same for both the *1P37* tube and the *868.* These are made by control of anode supply voltage.

(8) *Optical System Focus When Using Both Types of Phototube.*—A standard 1¼-mil slit image optical system was focused for maximum output using a 7000-cycle loop of film and an *868* red-sensitive phototube. Output readings were then taken for both types of phototubes. No observable increase in output was obtainable with the *1P37* tube by refocusing the optical system. This test was then repeated using a 9000-cycle loop of film. The results were identical.

This observation seems to substantiate the assumption that there is no need to refocus a standard 1¼-mil slit image optical system when the *1P37* tube is used in place of the *868.*

(9) *Relative Frequency Response.*—For this check a standard theater reproducing channel having an optical system with a 1¼-mil slit image was adjusted for maximum focus using a 9000-cycle loop. No low-pass filter was used, since this might have had the effect of making relative output at the higher frequencies. Frequency runs were then made using a calibrated test film which included 31 different frequencies between 30 and 9000 cycles. Response measurements revealed no difference in relative frequency response when the *1P37* tube was substituted for the *868.*

Reports from the field are awaited in order to better judge the seriousness of the increased hum, and greater variation in signal level with changes in exciter lamp voltage obtained with the *1P37* tube. No attempt will be made at this time to evaluate the seriousness of these two points.

It is felt, however, that the increased hum might be satisfactorily compensated by modification of the 120-cycle hum filter in those installations which operate with raw a.c. on the exciter lamp. For those installations which operate with d.c. exciter lamps and which have some form of regulation of the exciter lamp voltage, it does not appear that the latter point would become a problem.

In the meantime, however, the tubes that have been substituted are working very well, indicating that no differences in operating characteristics have been observed, or else are not of sufficient magnitude to justify an immediate report.

Eastern Production Hypo By New Colonial N. Y. Studio

Eastern film production will get a long-awaited shot in the arm with the opening of the new Colonial Pictures studios at Yonkers, N. Y. These studios will offer producers of all types of film—entertainment, industrial and religious—facilities comparable to the most modern West Coast plants. The Colonial lot will comprise 17 acres on which will be three stages 100 x 80 feet and having 40-ft. ceilings, in addition to an administration building.

Included in the RCA recording installation is the first of a new type equipment for 200-mil push-pull scoring, de luxe channels using "tea-wagon" mixers, 8 Selsyn interlocking re-recording dummies, and an 8-position mixer with re-recording compensation for each mixer position. Several dummies are equipped to re-record the 200-mil push-pull track. RCA will also supply a portable studio recording channel for use either "on stage" or on "location." Studios will open in 1947.

J. E. McAuley Dies; Maker of Magnarc Projection Lamps

John E. McAuley, president of J. E. McAuley Mfg. Co., Chicago, and a pioneer manufacturer of projection arc lamps under the trade name of Magnarcs, died on August 21 after a long illness. McAuley was well known to thousands of projectionists as a result of his keen interest in the projection process and, in former years, through his extensive visits to all parts of the country for personal demonstrations of his company's products.

The Laboratory Operator

By RUSSELL L. McKNIGHT

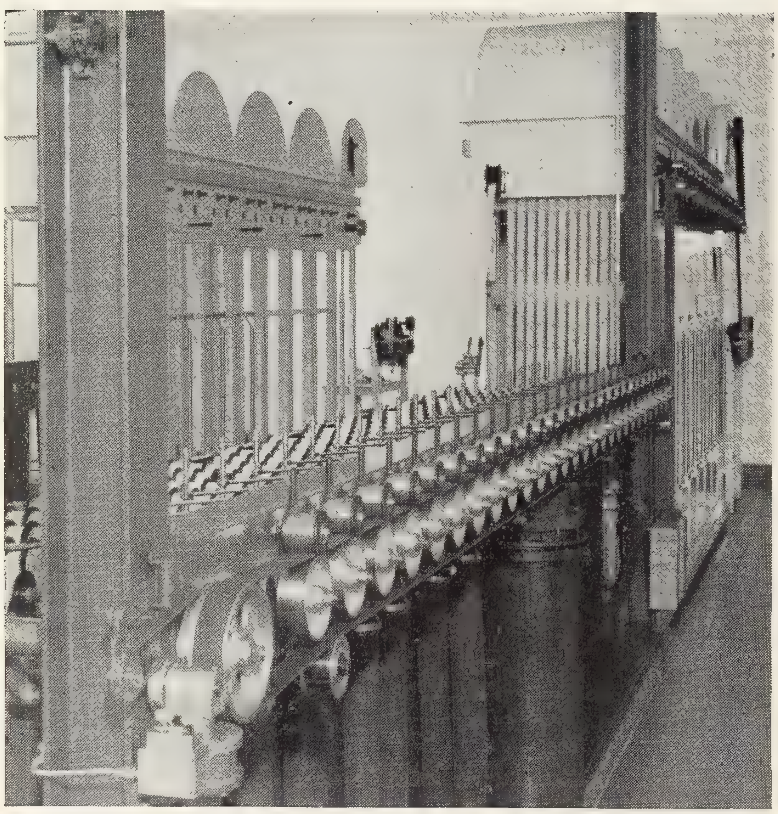
I.A. Film Technicians Local 683, Hollywood

DURING negotiations producers' representatives consistently make heedless statements concerning the relative merit, value and responsibility of laboratory operators. Every impartial observer contradicts such opinions, including lab superintendents, who have no difficulty understanding the importance of these technicians. One of the most important lab technicians is the machine operator who develops the negative film and whose worth may only be appreciated when we examine the nature of his work, the huge cost of materials he handles, and the woefully inadequate wage he receives.

Let's start with a typical operation. When the negative operator comes to work, the white lights are on. He starts at one end of the machine and follows the path of the leader threaded up in the machine for a thorough inspection. He notes that all spools have leader on them, that there are no cross-overs to hinder the free travel of the film, and he tests all the spools for tightness and looks for any tears that might have occurred in the leader. Every inch of leader is inspected from wet to dry end.

He then takes a thousand feet of leader and runs it at the approximate speed at which he is going to develop the film. During the time the film is going through, he checks for tension and watches the machine in operation so as to be sure that it will be safe during processing.

After this operation out go the lights and the operator begins inspection and make-up of each roll of negative, on the rewind, in total darkness. Inspection is made by rewinding the film through the fingers and exerting a slight pressure against the edges of the film so that any defect will be more noticeable. If weak spots are found, they are patched or taped to reinforce them against breakage in the machine. Tests pulled from various reels of negative are canned up and put to one side for development. Gamma strips are run through and gamma strips are attached to the tests pulled from the inspected reels, and these are also developed. During this operation thousands of feet of tests and leader have been going through the machine and every inch has been inspected.



Film negative developing machine consists of a series of tanks containing the processing solutions and a series of cabinets called "dryboxes," wherein the film is dried by means of blowing air into the cabinets at a fixed temperature. Approximately 4000 to 6000 feet of film are in the machine when it is fully threaded with leader or film.

The operator is now ready to begin the main run of the negative for the day. While the machine is running the operator patrols the machine, checking the cross-overs because that is where a break usually shows up.

Constant Machine Patrol

The motion picture negative developing machine, with slight variations in some laboratories, consists of a series of tanks which contain the processing solutions and a series of cabinets called dryboxes wherein the film is dried by means of blowing air into the cabinets at a fixed temperature. In each tank and cabinet is a shaft and on the top and bottom of each shaft there are a series of spools. Depending on the type of machine and tank, the number of spools vary from 3 to 15 per tank and cabinet.

At the "wet end," or tank section, of the machine is a magazine where the exposed undeveloped negative is run into the developing solution, and at the "dry end" is a take-up reel. Approximately 4000 to 6000 feet are in the machine when it is fully threaded with leader or film.

When an operator has finished a day's run of negative, he has been responsible for work that is valued at upwards of $40,000. Studio people, both workers and executives, for the most part do not realize the huge responsibility that devolves upon lab operators. Hundreds of thousands of dollars are concentrated in this narrow strip of film. Studios will pay handsome sums to "experts" in various lines, to stars, craftsmen, etc., to obtain the highest quality picture possible. Yet, when the sum total of their investment is handed over to the laboratory they ignore whatever value and responsibility these men and women have in maintaining and handling for them this same investment. If anyone doesn't believe that, just tell them what a lab operator earns!

Negative Stock Price Rise

Following the decontrol by OPA of raw film stock, Eastman Kodak positive raw stock has been boosted from $9.67 per thousand feet, including a 15% excise tax, to $11.38. Price rise does not affect negative raw stock or that of 16- and 8-mm film. Du Pont has also upped its raw stock price by 13% and now sells for $10.92 per thousand feet.

Increased labor costs and a Congressionally-authorized rise in the price of silver occasioned the boosts. Increased cost to the movie industry, which consumes 1,500,000,000 feet annually, is figured at 2½ millions.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Better Sound-Reproducing Equipment?

By *CLEMENT VERITAS*

The name ascribed to the author of the accompanying article is a nom de plume for a serviceman who has had a long and varied experience in the theatre field since the inception of sound pictures. His current contribution, in two sections, is the first of a series of similar articles which will appear in these pages.

WHEN sound equipment was first produced, it had mechanical faults to be sure, but in retrospect the electrical system was ideal. The general scheme was to "pick off" the sound from the film, amplify it, "fade" it, then amplify it once more and pass it on to the loudspeakers. The film amplifier was close, very close, to the photocell, its output impedance was low, and it had adequate facilities for balancing its output with that of another.

By virtue of the "faders" used, a dual unit with a common contact leaf, or switching facilities in a circuit not prone to introduce noise, each reproducer set was totally independent of its brother. This system was analogous to "high-level mixing" systems as applied to high class radio or PA facilities. It was not cheap, but it was *good*.

This scheme remains unsurpassed wherever the best possible quality of reproduction and freedom from operating difficulties is desired.

'Thumbs Down' to H-I Systems

As we look about us today, we see many deviations from the aforementioned scheme, and we wonder if manufacturers, in their competitive efforts, have forgotten that fundamental goodness is something to prize, something to strive for, and something that they owe their customers. Had their customers but the slightest technical knowledge, they would unhesitatingly have put thumbs down on high-impedance sound systems.

Why should they risk disturbance in their sound from various noise-producing sources common to all projection rooms for a saving of the price of three transformers? Why, too, should this price-saving penalize them to suffer possible disturbance from a good amplifier during such times that its brother may be in trouble?

Of course, low-impedance sound systems develop troubles too, but by comparison they are minor. Besides being less susceptible to stray noise pick up they are flexible and easy to use. They may be used as isolators, and volume controls may be placed anywhere within reason.

Other Desirable Ends

Should we be asked to design a sound system, we would certainly bear the foregoing in mind and develop the completed article on a basis proven sound. We would also refrain from switching in low-level or noise-producing circuits, provide adequate facilities for balancing reproducers and adequate gain, with continuously variable control, in the main or voltage amplifier.

We would also obtain the desired power by means of adequate tubes without resorting to paralleled amplifiers. "Faders" or their equivalent would have an adequate spread. Facilities for energizing all exciter lamps continuously would be a *must*.

The foregoing is not intended as a criticism of equipment as manufactured by anyone, but a plea for a fundamental design of proven merit, a design that will enhance the many desirable features contained in equipment of current manufacture and result in a system of which an exhibitor can be truly proud. It is our belief that the industry wants the *best* and is willing to pay for it.

Testing Amplifiers Having a High-Impedance Input

CONTRARY to prevailing opinion, the 49-type amplifier, many of which are in service, may be readily tested in the field, either while installed as a part of the sound system or while on a work bench. Of most importance is a method of checking their gain. This can readily be done at 60 c.p.s. using a low-voltage source of signal and a volume indicator.

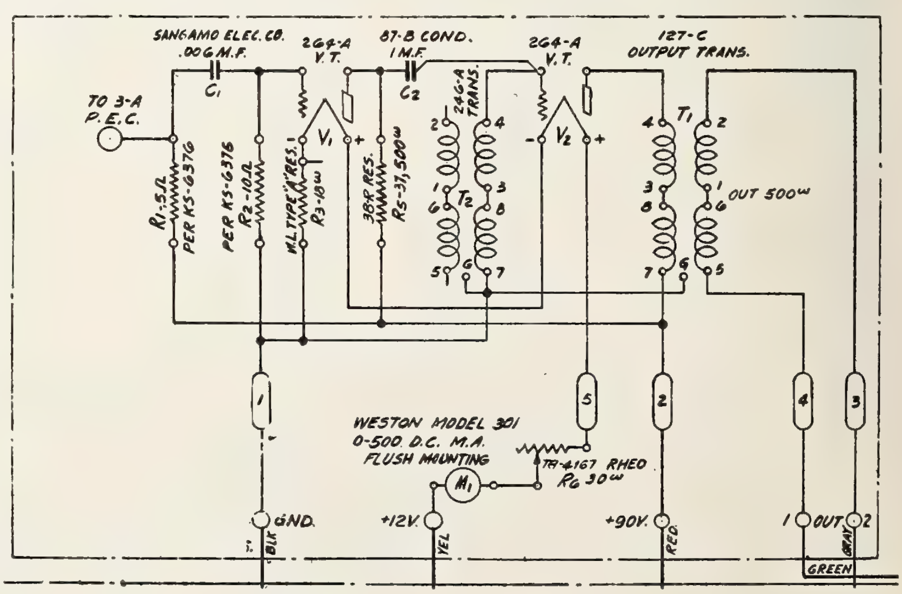
A bell-ringing transformer feeding a 1000-ohm potentiometer is ideal. Adjust output of potentiometer to minus 12 db and apply that signal directly to the amplifier input. Connect the V.I. to the amplifier output, making sure that the amplifier is properly loaded.

If the amplifier is a part of the sound system, it is usually loaded by means of a "Fader"; however, some systems such as those using the 713 type Control Cabinet, do not provide this loading. If the amplifier is on a bench, load its output with a 500-ohm resistor. The difference in readings between output and input thus obtained is the voltage amplification of the amplifier in db, and for field use the value obtained will be sufficiently accurate.

Accurate Gain Figures

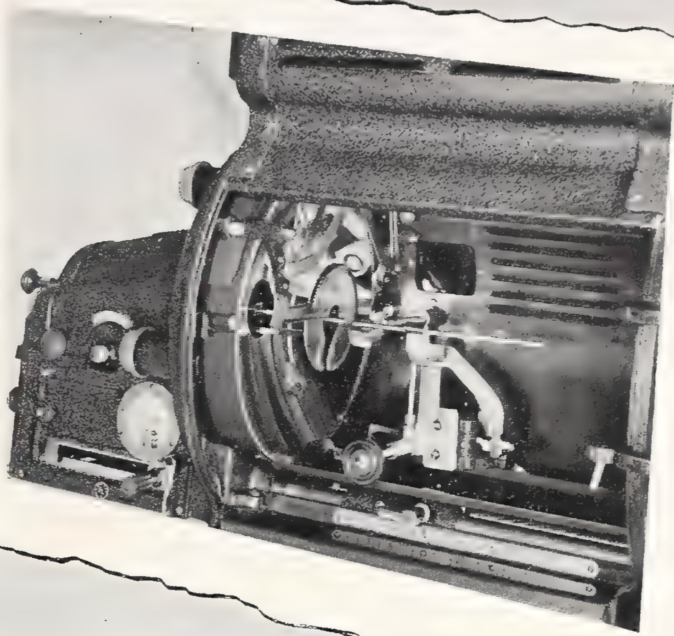
Older equipment bulletins indicated the voltage amplifications in db's of the various film amplifiers. Since these figures were not significant as to amplifier gain when it was connected in a system,

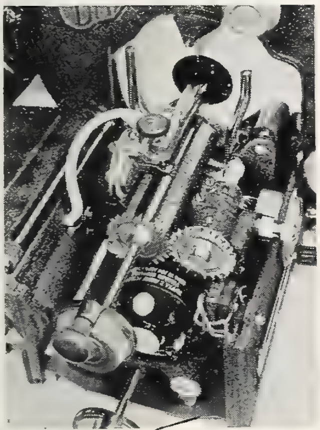
(*Continued on page* 25)



Schematic of a 49-type W. E. amplifier.

Inside story of the BRENKERT ENARC LAMP





IMPROVED DESIGN and unit construction are features of Brenkert Enarc Lamps that mean work-saving maintenance and service . . . long mechanism life . . . uniform and brilliant screen illumination.

Negative carbon jaw assembly and motor and gear case assembly are separate, independent units. All units are quickly removed and replaced for cleaning and service without disturbing the accuracy of alignment.

Full opening doors on both sides of the lamphouse swing out of the way in a horizontal position, are quickly detachable, for work-saving convenience.

Controls for adjusting reflector, carbon alignment, motor speed and other arc-lamp controls are all conveniently placed for ease of adjustment, from any position on the operating side. No controls "stick out" where they might be accidently jarred or moved.

All controlling mechanism is mounted in the low-temperature chamber on back of the lamphouse, away from carbon ash and heat, and is completely exposed when the cover is open.

The entire negative carbon assembly slides backwards outside the lamphouse. The carbon can be adjusted *behind* the reflector . . . without difficulty . . . without danger to the reflector.

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The Industry's Safety Program

By HENRY ANDERSON
Manager, Insurance Dept., Paramount Pictures, Inc.

PEOPLE need not so much to be told as to be reminded. Most of us in our industry know the facts that are presented here; but from time to time, with the pressure of other matters, must be reminded of the important part that accident prevention and loss prevention pay in our industry. Our industry—unlike the steel, the automobile and the chemical industries, where machines produce the product and men are mere tenders of machines—is not a mechanical industry. Ours is an industry of people; our studio product is people "or a reasonable facsimile thereof." In our exchanges people, not machines, are the important factor, and in our theatres our own people direct and are responsible for many millions of other people.

Thus, we cannot, as can some other industries, prevent accidents by merely clamping some ingenious mechanical device upon a machine, but we must rather educate our own people and, as far as possible, the public, too, in safe practices. Our problem is a human one, not a matter of erecting robots.

Our industry has an excellent reputation in the safety field. But this reputation had to be earned, and *has been earned*, only by the intelligent cooperation of a large number of persons in the industry. It can be maintained only by the same continued effort. But what does this all mean from a practical standpoint? In theatres, our primary responsibility is to the audience, and we assure its safety by observing the following:

Basic Theatre Safety Requirements

(1) Preventing the occurrence of any emergency in the theatre; (2) Designing the theatre to take care of emergencies; (3) Training the theatre staff in the handling of emergencies.

Most important of these is preventing the occurrence of any emergency in the theatre. This requires that the theatre be so operated and maintained that nothing will go wrong. This means discovery of any hazardous conditions, maintaining excellent housekeeping, and maintaining all equipment, particularly projection equipment, in first-class condition. This is done by periodic inspections of which a written record should be made.

A theatre inspection should literally start at the roof and end at the janitor's closet in the basement, covering every point in between. It should cover among other things: conditions of tanks or other structures on roof; signs, marquees, roof spaces, chandeliers, plaster, lighting, including emergency lighting; test of exit doors, fire extinguishers, hose, stage, test of asbestos curtain; test of stage skylight; projection room, with test of port shutters and other devices. In fact, there is nothing so unimportant that it may be safely overlooked.

In designing the theatre to take care of emergencies, we find that the modern building code provides about every reasonable safeguard that can be devised. We would be at a loss to know how to make a modern, well-designed theatre safer than it is. The modern theatre can be emptied in three minutes. The writer has often made the statement that people are safer in a theatre than they are in almost any other pursuit in life; certainly safer than they are in their homes, on the streets, or in their automobiles.

Training the theatre staff in the handling of emergencies is another important safeguard. Here we enter into human relations. Studies are being made of crowd psychology so that we may better know how to handle audiences more safely. The well-operated theatre selects active, intelligent young men as ushers. These men are under military-like discipline. They transmit this feeling of discipline to the audience, and inspire confidence by their bearing. They are trained in the handling of crowds, and have full control of the situation at all times. These ushers are drilled at regular intervals. At these drills each man performs the actual routine to be employed in case of real emergency.

Two General Types of Emergency

Two general types of emergency are recognized in theatre operation: a local emergency and an emergency that may necessitate clearing the house. Existence of the emergency is signaled by using the words "Emergency number one" or "Emergency number two," as the case may be. Or code words may be used. No words are used which might in any manner alarm the audience.

A local emergency might involve a disorderly person, a fight, illness, or some other similar occurrence. Such disorders must be put down promptly, firmly, but tactfully. Some theatres have been subject to epidemics of rowdyism. In such cases the cooperation of the police and courts should be sought, explaining to them the seriousness of a theatre disturbance. Where cooperation is obtained, offenders will be dealt with summarily and an example made of them. In cases where it has been possible to get this cooperation, the courts place offenders on probation for a long period. They have now learned that a theatre is no place for an exhibition of rowdyism.

If the emergency be such that it is necessary to clear the house, the ushers open the exit doors and with a few simple words ask the audience to leave by the nearest exit. The staff has been trained to remain calm at all times and thus to impart calmness to the audience. At the first sign of trouble the house lights are turned on. The performance is continued as long as possible. Music is played, by either the orchestra or mechanical means. The theatre has a long tradition of successful handling of emergencies.

One important measure that must never be neglected is the flameproofing of draperies, curtains, and other fabrics. Modern flameproofing chemicals properly applied are effective. Great care should be exercised to see that the

(Continued on page 24)

IP AT YOUR SERVICE

This department is devoted to the man behind the man behind the gun—the serviceman. Its prime purpose is to promote a closer relationship between projectionist and serviceman based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. Contributions from both groups are invited.

ON EACH projector where an enclosed base is used, install a length of No. 2 wire tirex rubber cable in such a way that it will be attached at one end to the 110-volt supply inside the projector base. Pass the cord through a small pulley and weight which will pull the excess back into the base when the light is not in use. A standard socket and bulb of the projectionist's preference is attached to the other end. A small Alnico 5 PM slug can also be attached to the socket so that it will stick to the metal parts of the machine.

With one of these on each projector a handy trouble lamp will always be available, and will be entirely out of the way when not in use.—R. SHEPHARD, *RCA.*

Simple Dummy Fader Extension

At one theatre where volume control was on the amplifier on the side wall, the projectionists made an extension by drilling two small holes in the knob surface so two prongs on the end of a round rod would fit into the holes. The man in between the machines could turn the rod that rested on top of the lamphouse.—R. H. HECHT, *RCA.*

Preserving Test Film

Du Ponts suggest keeping the blotter in film can cover moistened with water and glycerine to preserve film. About thirty parts of water to one of glycerine is satisfactory.—R. H. BISBEE, *RCA.*

Tightening Pad Roller Set Screws

In several instances where the set screw that holds the pad roller shaft in the bracket (MI-1040 heads, etc.) has been tightened to the point of stripping the threads in the arm, the remedy is quite simple. Tap said bracket, and use 12-32 Allen set screw. (During an inspection when sprockets are replaced, salvage the 12-32 Allen set screws.) So far no repeats.—R. J. DEL CASTILLO, *RCA.*

Improving the Sound Level

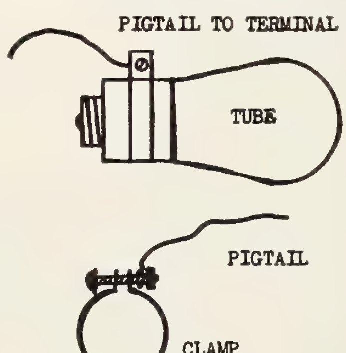
One of my theatres, using WE 209 soundheads, had oil in the optical unit. While reproduction quality apparently had not been affected, the output level was much lower. I brought the level back to normal by shifting the exciter lamp slightly in its socket until maximum light passed through the lens, prism and to the photocell. Since the prefocussing sockets have three spring-mounted studs, any insulating shims, such as cardboard, can be placed under the lamp ring or flange to hold the lamp in the best position. Fader volume setting was reduced from 18 to 13 in this instance.—R. H. BISBEE, *RCA.*

Reconditioning Exciter Lamp Holders

In the older soundheads, using the 21423 exciter lamp holder, the 20061 screw becomes very difficult to turn, apparently due to the oxidation of the die-cast metal of which the holder is made, thus making it rather difficult to adjust the exciter lamps. A few minutes spent in removing the screws and running a 10-32 tap through the threads will restore these sockets to a condition as good as new.—K. E. STEPHENSON, *RCA.*

Rectifier Tube Contact

Where trouble is experienced with the spring contact against the 5-ampere mercury type rectifier tube, a small clamp,



similar to that used for holding capacitors, may be used to make connections with the tube base. A flexible pigtail should be attached to a clamp and the other end connected to the rectifier terminal [see Fig. 1]. — E. J. DUSTIN, *RCA.*

Emergency Changeover Operation

Shorts to ground sometimes develop in the exciter lamp switching circuit of Simplex systems, usually between TS3, the terminal board carrying this circuit, and the bracket holding it in position in the 101 volume control amplifier. Due to the mass of wiring behind this terminal strip, clearing the trouble during a performance is just about out of the question, if loosening the screws which holds the strip to its mounting bracket does not suffice.

An alternative is to remove the system ground wire from the common terminal in the power unit temporarily and until the short ground can be eliminated in the switching circuit. Little difference in hum level will be noticed, and switching will be normal.—C. C. NAGEL, *RCA.*

Installing a V-Belt

To install a V-belt, release the adjustment bolts on the motor and move the latter forward so that the belt may be slipped into the groove without forcing. Never pry a V-belt onto a drive with a screwdriver or other tool, or force it over the pulley rim as it revolves. Where there is insufficient takeup, remove one of the pulleys to slip the belt on.

Check V-pulleys for correct alignment; on certain types of equipment rubber mountings may have become worn, permitting the motor to twist out of alignment. Check also for worn V-pulley grooves, and also for chips and burrs. These conditions must be corrected for satisfactory belt service.

Dual belts should always be replaced in sets. When a new belt is installed alongside an old belt that is well broken-in, the new belt, which has not been stretched or settled in the grooves, is forced to carry the load. The old belt that is removed may be reserved for replacement use later.

Be sure that the belt is installed at the proper tension. Especially check after the first day or two when the belt has been broken-in, unless there is spring tension on the drive to provide automatic adjustment. A belt may be considered to have proper tension if halfway between the sheaves it can be twisted a quarter turn with some effort.—HARVEY SEARS, *I. A. Local* 306, *N. Y. City.*

IN THE SPOTLIGHT

By ***HARRY SHERMAN***

WE SHOULD like to suggest to those in charge of the forthcoming joint TESMA (Theatre Equipment Supply Manufacturers Ass'n) and TEDPA (Theatre Equipment Dealers Protective Ass'n) convention slated to be held in Toledo, Ohio, November 8-11, that an adequate display of projection equipment at convention headquarters be assured prior to soliciting projectionist attendance at the meeting. Projectionists who take the time and trouble to attend equipment exhibitions are interested in equipment *only*—they want to learn about the latest technical developments and are not interested in the business policies of equipment manufacturers and dealers.

Last year, prior to the TESMA-TEDPA convention in Chicago, we urged as many readers as possible to attend the conference in order that they might become acquainted with the latest technical developments. We received complaints from a number of projectionists who, at their own expense, attended the convention expecting to see many new and interesting developments, only to leave the convention with a feeling of time and money wasted.

One reader in particular, G. R. Mann, working in Urbana, Illinois, was pretty hot under the collar. In his letter to us he stated that upon our advice he placed another man on his job (paid his salary) and went to Chicago to see what the manufacturers had to offer in the way of new and improved equipment. He wrote that the few equipment exhibitions he did see were scattered in different parts of the hotel and that he spent most of his time trying to locate the exhibition rooms of the others. He couldn't understand (and neither could we) why all equipment wasn't displayed in one room so that there would be no time lost in tracking down a display.

● A note received recently from a subscriber in Wellington, New Zealand, advises us of a new regulation now in effect there banning managers from projection rooms. Motion picture theatre managers must remain in the front part of the house and are forbidden to operate projection machines. It had been customary for managers to pinch-hit for projectionists, either as relief men or as assistants, but the new ruling requires two men in every projection room and states that an assistant projectionist may be left in charge only in case of emergency.

● Steve D'Inzillo, member of New York Local 306, was appointed acting business agent by president Gelber to take over the duties of Morris Kravitz, business agent, who has been ill for the past several months. At the last meeting of the local the membership voted to retain Kravitz on full pay during his illness.

● I. A. President Walsh paid a surprise visit to the quarterly meeting of District Council No. 2 (Calif.), which was held the latter part of last month at the Hollywood Athletic Club. He addressed the members, pledging the full support of the Alliance to all I. A. locals—small as well as large.

● Attention Milwaukee Projectionist Local 164: Local 248 UAW-CIO (Allis-Chalmers) is now teaching 16-mm projection to members of various CIO locals in your state, according to a statement released by Silvia Schuster, union committeewoman.

● We were shocked to hear of the death of Charles O. Smith, member of Local 466, Ft. Wayne, Ind. Smith, a member of the local for 28 years, worked as an electrician as a sideline, and died from injuries received when he was investigating trouble that had developed on a high-voltage line. Although rushed to the hospital immediately after the accident, he failed to respond to treatment and died several days later. He is survived by his widow, mother, daughter and grandchild.

● Evidently the National Association of Visual Education Dealers (NAVED) don't read these columns, for if they did they might have saved themselves quite a bit of trouble and inconvenience at their recent Chicago conference. They would have known that Gene Atkinson, Local 110 business manager, is very much on the beam and is constantly on the watch for non-union activities in pro-

Kudos for I.A. from Noted Columnist

PERSUASIVE evidence of the strong comeback of the I. A. within the past few years and its emergence with considerable prestige as one of the top-flight units of the Labor movement is at hand in the appended excerpt from a recent column in *The New York Post* by Victor Riesel, ultra-discerning and hardboiled nationally-syndicated labor editor and radio commentator:

. . . The international theatrical union (I.A.T.S.E.) . . . met in convention the other day and there were no goons among its delegates—just stagehands, cameramen and electricians, their wives and kids running in and out of Chicago's huge Hotel Stevens to catch the lake front breeze.

The delegates, all honestly elected, were called to order by their president—stocky, bespectacled Richard F. Walsh, a former Brooklyn stagehand. He succeeded the Bioff mob and did the unprecedented at that time when he cut his term in office from four years to two. Now he must fight every second year for re-election to the job. . . .

That fight for the presidency is honest—and the nation's other unions would do well to clean up their election system by handling the voting as the theatrical union does. The I.A.T.S.E. convention delegates elect their leaders. Each delegate gets a paper ballot which he marks secretly in a closed booth. Contrary to exhibitions which pass for free elections in other national unions, the opposition candidates here really have freedom. They put their newspapers and literature on each delegate's seat.

The union issues a certified financial statement regularly and works with the FBI on ferreting out gangsters who carry its cards. . . . This amusement industry union—with its 60,000 members—is pleasant to watch, especially for those of us who have been writing of the shenannigans of the men who lead unions with 10 times that number.

Mr. Riesel's omission of the numerically-superior projectionist group and other I. A. crafts was, we are sure, inadvertent.

jectionist circles. The association "forgot" to employ a union man to operate projectors at its convention, but Atkinson reminded them very quickly when he stopped all shows until their memories were refreshed sufficiently to engage a Local 110 man. Some people like to learn the hard way.

● In an address to the executives of his company, the president of a prominent motion picture producing company made the following very interesting statements: ". . . 1944-45 were the most prosperous years in the history of the motion picture industry. Exhibitors and distributors increased prices on a wholesale basis . . . prosperity of 1944-45 has continued in 1946 . . ."

We have a transcript of his address in our files, copies of which we will gladly send to any interested union official.

● George Dove, 75 years old, member since its inception of New York City Local 306, died early this month shortly after filing application for retirement. Dove worked as projectionist at the Rialto Theatre in Times Square until very recently.

● We are sorry to learn of the illness of John A. Martin, business agent for Local 89, Alliance, Ohio. He has our best wishes for a speedy recovery.

● Atlantic City Local 310 reports new wage scales for its members showing increases ranging from $5 to $18.50 per week per man, wo men to a shift. Thanks for the dope, Gus.

● Congratulations to the Al Spayds, Local 554, Lebanon, Penna., on the arrival of a seven-pound son, Jack.

25 Years Ago—September, 1921

● New York City exhibitors asked the membership of Local 306 to take a 20% cut in wages. . . . The burlesque strike was settled by I. A. President Jim Lemke. . . . The executive council of the AFL cabled Lloyd George, prime minister of England, urging him to continue the truce with Ireland. . . . J. H. Tregoe, executive secretary of the National Association of Credit Men, said that the declaration of the AFL that labor cannot accept a lower wage while living costs maintain its present level is a fact which merchants of the country should take to heart. . . . Judge Landis handed down a decision in an arbitration of the Building Trades situation in Chicago in which the decreases ranged to 26½%. The carpenters and plumbers refused to accept it. . . . R. E. Morris was secretary of Local 519, Mobile, Ala., which office he still holds. . . . The official I. A. family was as follows: James Lemke, pres.; Wm. F. Canavan, 1st vice-pres.; Richard J. Green, 2nd vice-pres.; Fred J. Dempsey, 3rd vice-pres.; Wm. P. Covert, 4th vice-pres.; Henry C. Hollinger, 5th vice-pres.; Frank G. Lemaster, general sec.-treas.; Harry L. Spencer, ass't pres.; and Wm. W. McKinnon, mgr. claim and org. depts. . . . Los Angeles Local 150 requested that no more projectionists come to that city looking for work. . . . One-year contracts calling for increases in salaries were signed by the following I. A. locals: 381, Haverhill, Mass.; 424, Fall River, Mass.; 529, Long Branch, N. J.; 49 and 373, Terre Haute, Ind.; 413, Gadsden, Ala.; 443, Jefferson City, Mo.; 422, Ashtabula, Ohio; 493, Spokane, Wash.; 330, Ft. Worth, Tex.; 124 and 374, Joliet, Ill.; 72, Norfolk, Va.; 87, Richmond, Va.; 298, Elmira, N. Y.; 561, Johnstown, Penna.; 594, Washington, Iowa; 579, Woonsocket, R. I.; 354, Tulsa, Okla.; and New York City Local 1. . . . Local 579, Woonsocket, R. I, advised the General Office of two scabs working in their jurisdiction, namely, David Stubbs and A. B. Steele. . . . And Syracuse Local 9 informed the General Office that an imposter named Frank Haynes was touring the country posing as a member of Fall River Local 57 and borrowing money on the strength of his "membership" in that local.

THOMAS WARD HONORED ON RETIREMENT BY PARKERSBURG, W. VA., LOCAL 100

Scene at party on August 15 honoring Thomas Ward, 72, ex-president and business agent of Local 100 for more than thirty years, on eve of his retirement. Gathering was held at the historic Hotel Blennerhassett overlooking the Ohio River. Shown here (left to right) are: William Pahl, treasurer; Ward; Danny Mulvihill, vice-president; E. A. Earley, secretary, and Charles Miller, president. Other Local 100 members who attended were Shirley Radekin, Harold Grubb, Thomas Piatt, Ivan Anderson, Victor Wilson, James Smith, Ben Montgomery, and Car Annon.

● James Whitebone, business agent for Local 440, St. John, N. B., and vice-president of the Canadian Trades and Labor Congress, is one of three theatremen in Canada hanored by the King of Eng-England for their war efforts. Whitebone was made a Member of the Most Excellent Order of the British Empire, and now may add the initials MBE to his name. He won his award for splendid wartime service.

J. Whitebone, MBE

Incidentally, the three theatremen to receive decorations are all associated with Canadian Famous Players: Whitebone is chief projectionist at the Capitol Theatre in St. John; the other two men are J. J. Fitzgibbons, president of the company, who was named Commander of the Most Excellent Order of the British Empire; and Jack Arthur, who was also honored with an MBE.

● Recent out-of-town visitors to the offices of I. P.: A. E. Bradshaw, Local 175, Tacoma, Wash.; Thad Barrows, Local 182, Boston, Mass.; Hal Huff, Local 150, Los Angeles; Pat Offer, Local 165, Hollywood, Calif.; Bruce Self, Local 225, Atlanta, Ga.; V. S. Schooley, Local 316, Miami, Fla.; Eddie Miller, Local 279, Houston, Tex., and Leon Charlip, Toronto Local 173.

● The new contracts recently negotiated by Dick Walsh for I. A. sound servicemen with the two major service companies—RCA and Altec—have eliminated the patent waiver clause whereby these companies were given exclusive rights to any device invented by their employes.

● A 15% increase, retroactive to May 1, 1946, was the basis for a new agreement between New York City Local 306 and the Independent Theatre Owners Association. This contract runs to September 1, 1952. We understand, however,

(*Continued on page* 31)

Basic Radio and Television Course

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XXVI—RECEIVING SYSTEMS

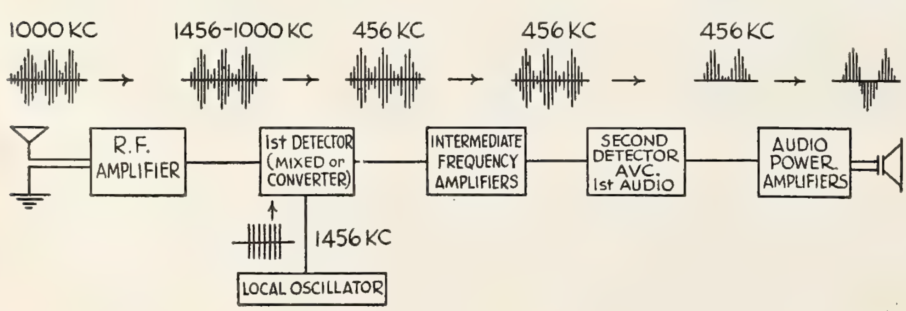
IN THE preceding article (I. P. for August) the T. R. F. receiver was designated the best of the many types which have been considered up to this time. It has more sensitivity, selectivity, and better fidelity than any of the types previously considered. We noted that the T. R. F. receiver has not been produced in large quantities for a number of years, due in large part to the marked superiority of the superheterodyne receiver. The latter is more selective and more sensitive than the T. R. F. and, with careful design, can have good tone quality. The superhet can be produced almost as cheaply as the T. R. F. despite the fact that the former's circuits are somewhat more complex than those in the latter.

Figure 1 is a block diagram of a typical superhet receiver. The first stage is a radio frequency (RF) amplifier which is tunable over the broadcast band from 550 to 1650 kc. Not all superhets have a stage of tuned RF amplification. The small, inexpensive receivers usually omit this stage, while the very expensive types may contain as many as two such stages.

One or two stages of RF amplification are really advantageous because such amplification increases selectivity and sensitivity and helps to reduce image interference (to be discussed subsequently). The RF amplifier is difficult to design, the amount of amplification possible therewith is not great, and its use leads to tracking difficulties. These are the main reasons why this amplifier is omitted in inexpensive receivers.

The second block schematic shows the local oscillator and the first detector. This stage differs radically from any circuit previously discussed. It contains an oscillator of either the Hartley, Colpitts, or Armstrong types. Other types of oscillators are used occasionally, but the three types mentioned are the most popular.

FIGURE 1. Superhet block diagram.



Another section of the second block diagram is called the first detector, sometimes called a mixer. Special tubes have been designed which perform the functions of oscillator and mixer simultaneously. When such a tube is used the entire block diagram of this stage is called a converter. In the converter stage the incoming signal is combined with the local oscillator in a non-linear amplifier. Several other frequencies are created as a result of this action. For example, suppose that the receiver were tuned to 1000 kc and the local oscillator were tuned to 1456 kc. Several "sum" and difference frequencies, such as 2456 kc and 456 kc and their harmonics, would result.

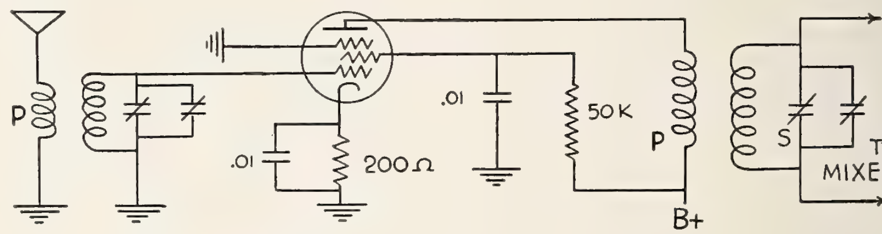


FIGURE 2. RF amplifier.

The next stage is called the intermediate-frequency (IF) amplifier. This amplifier, not continuously tunable, is designed to tune only to the intermediate frequency which in most receivers is 456 kc. It is designed to accept the difference in frequency between the incoming signal and the local oscillator. In such a receiver the IF amplifier will not accept the sum of the incoming signal and the local oscillator or any of the harmonics. The local oscillator in most receivers is designed to tune above the incoming signal, some exceptions being in FM and other high-frequency receivers.

The basis for the success of the superhet receiver lies mainly in the IF amplifier. Designed to tune to only one frequency, this amplifier involves no tracking problems, as is the case with the RF amplifier. The IF amplifier stages are mainly responsible for the good selectivity and sensitivity of the superhet.

The second detector stage in the superhet is similar to the detector in the T. R. F. receiver. A diode detector is generally used because of its all-around proven superiority. Modern receivers use the 6SQ7 or 12SQ7 tubes or equivalent types in the detector stage. These tubes contain two diodes and a triode amplifier. The diodes are used for detection and automatic volume control; the triode section is used for the first audio amplifier. The audio amplifier contains one stage of single or push-pull audio amplification and is known as a power amplifier.

The Radio-Frequency Amplifier

The block diagram will now be broken down into actual circuits as they exist in typical superheterodyne receivers. Fig. 2 shows a diagram of an RF amplifier of the type used in modern receivers. The tube used in this circuit is practically always of the pentode type, which are used because of their high transconductance, meaning that they will have a high gain. Coils are of the high-impedance primary type. The variable condensers are about 350 to 410 micro-micro-farads at their maximum settings.

The 0.01-mfd. condenser which is connected across the 200-ohm resistor will have a low impedance to and will by-pass radio frequencies to ground, thus assuring a direct current bias on the control grid and preventing degeneration. The screen grid is operated with less positive voltage than the plate. The 50,000-ohm resistor in the screen grid circuit drops the voltage to the required value. The screen grid is by-passed to ground by the 0.01-mfd. condenser, this being necessary in order to keep radio frequencies out of the power supply.

The RF amplifier is designed to accept

all frequencies between 550 and 1600 kc, in the case of standard broadcast receivers. The output from the RF amplifier is fed into the mixer oscillator stage in the superheterodyne receiver.

The Mixer-Oscillator

Figure 3 shows the mixer-oscillator circuit. Reference to the block diagram of Fig. 1 shows that the output of the RF amplifier feeds into the mixer-oscillator and the output of the latter feeds into the IF amplifiers. The input to the mixer comes from the RF coil which is connected to the signal-grid of the 6L7-G tube. This tube, of special design, is known as a mixer tube.

In addition to the control grid, screen grid, and suppressor grids which are the normal complement of pentode tubes, the mixer tube contains an additional grid which is known as the oscillator-input grid. The output from the local oscillator is fed into this grid and is mixed within the tube with the incoming signal. The 6C5-G tube is connected in a conventional Armstrong oscillator circuit. The oscillator is tuned in the grid circuit by means of the variable condenser C.

It will be seen that a variable condenser is connected in series with the tuning condenser across the secondary of the oscillator coil. This condenser is smaller than condenser C and is known as the oscillator padder condenser. It is used in order to adjust the oscillator circuit at the low-frequency end of the dial. The procedure for making this adjustment will be covered when we discuss superhet alignment.

The mixing action takes place in the following manner: the incoming signal from the RF amplifier or from the antenna, as the case may be, is applied to the signal grid, while the signal from the local oscillator (pure RF) is fed into the oscillator-input grid. Both these signals are in the path of the common electron stream within the tube and they will both affect the electrons in this stream. This will result in several frequencies being present at the output of the mixer tube.

The signals present at the plate of this tube are the incoming signal, the oscil-

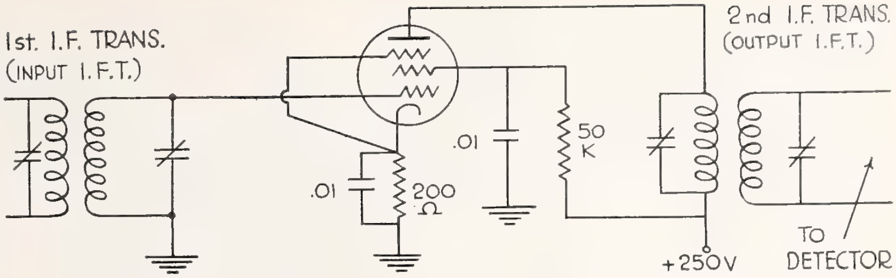


FIGURE 4. IF amplifier.

lator signal, the sum of the incoming and oscillator signals, the difference between the incoming and oscillator signals, and the harmonics of all of these signals. In a modern superhet receiver it is only required to make use of the difference between the oscillator and incoming signals. This means that some type of filter will be used in the plate circuit of the mixer tube.

Intermediate-Frequency (IF) Amplifier

The output of the mixer circuit is fed into a tuned transformer which is known as the first IF transformer. Because this

AUGUST QUESTIONS AND CORRECT ANSWERS

1. ***(Q)* Why should magnetic coupling between coils be prevented?**
   ***(A)* To prevent interference between circuits.**
2. ***(Q)* Why are tuning condensers ganged?**
   ***(A)* To facilitate tuning.**
3. ***(Q)* Why is a pentode better than a triode as an R. F. amplifier?**
   ***(A)* It does not have a tendency to oscillate and has more gain than a triode.**

is a tuned circuit it will act as a filter to all frequencies except the small band which it is designed to pass. The IF transformer is tuned to only one carrier frequency. This frequency varies with different receivers; but most of the present-day receivers use a frequency of 455 or 456 kc. Some of the older receivers used an intermediate frequency of 175 kc, and some used even a lower frequency. Many modern receivers have used a frequency of 465 kc, and some have used 262 kc. In general, a higher intermediate frequency results in less gain but better tone quality.

The values of IF just mentioned apply only to standard receivers and do not apply to FM and television receivers. Such receivers use much higher values for the intermediate frequency.

The trimmer condensers which are shown connected across the primary and secondary windings of the IF transformer are used only for alignment purposes. These condensers are adjusted only once at the factory. In some receivers the set screws from these trimmer condensers are sealed with sealing wax or with liquid solder.

Figure 4 is a diagram of an IF amplifier. A pentode tube is practically always used in this type of circuit because of its high gain and stability. Most of the gain of the superhet receiver takes place in the IF amplifier. The large amount of selectivity and sensitivity with which the superhet is credited is due mainly to the IF amplifier stage. There is only one stage of IF amplification shown in Fig. 4, although two IF transformers are used.

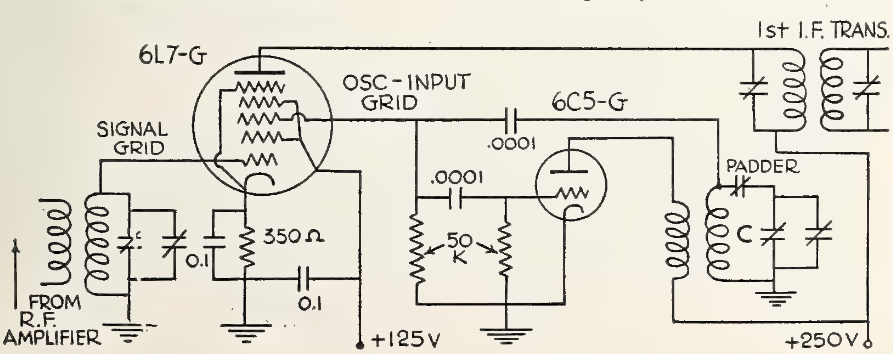
Most receivers, even the very expensive ones, use only one stage of IF amplification. Some receivers, designed for special purposes, such as communication types, use two and even three such stages. Such receivers are very sensitive and selective but usually lack good tone quality: the tuning becomes very sharp as the number of IF stages is increased, the result being that the circuit acts as a filter and cuts out some of the components of audio frequencies present in the IF carrier.

The IF transformers shown in Fig. 4 are tuned by means of condensers. In recent years powdered-iron slugs have been used for this purpose. This slug increases the inductive reactance of the coil without appreciably increasing its losses. This means that the coil will have a high Q and a correspondingly high gain.

The Diode Detector

In previous articles the superiority of the diode detector over other types was pointed out. We learned however, that the diode detector works best when the incoming signal is of medium or large strength. This factor limits the use of

FIGURE 3. Mixer-oscillator.



diode detectors to fairly strong receivers. The superhet is of this type due to the large amount of amplification in the IF amplifier.

Figure 5 shows a special type of diode detector circuit that is commonly used in present-day receivers. A tube of unusual design used in this circuit is known as a duo-diode, high-mu triode, combining in one envelope the functions of a diode detector and an audio voltage amplifier. The tube types usually used in this type of circuit are the 6SQ7 and the 12SQ7.

The diode plates are connected together and go to the secondary of the second IF transformer. The other lead of this winding goes to the ground through a 50,000-ohm resistor in series with a 500,000-ohm volume control. The diode plates conduct on the positive half-cycles of the IF carrier. The detected current flows through the volume control to ground. The voltage developed across the volume control will contain the audio variations which were originally fed into the microphone at the transmitter.

The 50,000-ohm resistor and the two .0001-mfd. condensers connected across it form a "pie" type of filter which removes the IF carrier from the audio output, thus keeping it out of the audio amplifier circuits where it could cause distortion.

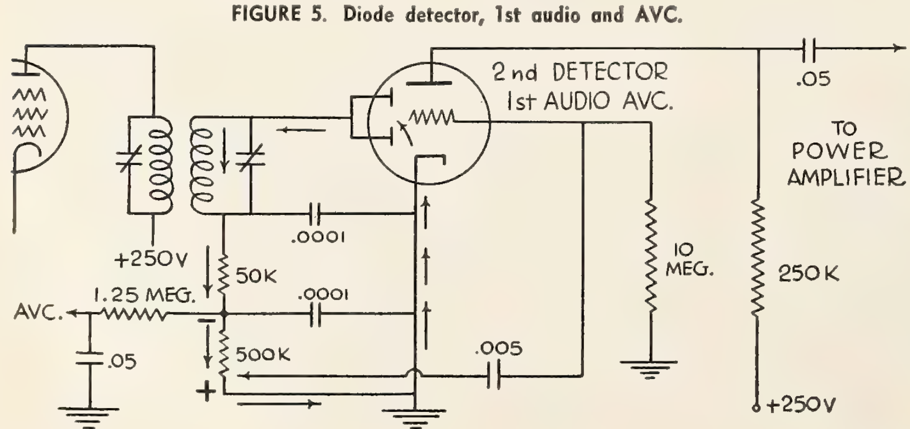
The audio output is connected to the control grid of the audio amplifier section of the combination detector-amplifier tube through a .005-mfd. coupling condenser. The 10-megohm resistor which is connected to the control grid and ground provides grid bias for the audio amplifier section of the tube and is known as a contact bias resistor. The plate circuit of this tube is provided with a positive voltage through the plate load resistor of 250,000 ohms, and the amplified audio from this circuit is fed into one or more stages of power amplification through the .05-mfd. coupling condenser.

Figure 5 shows that a 1.25-megohm resistor is connected to the junction of the 50,000-ohm and the 500,000-ohm resistors. The other end of this resistor is connected to ground through a .05-mfd. condenser. The circuit consisting of the diode return circuit and the resistor and condenser is known as the AVC circuit, its purpose being to provide a means for automatically controlling the volume of the receiver during fading distant reception and to prevent blasting when tuning in a strong local station.

The direction of the arrows indicates that the 1.25-megohm resistor is connected to a point which has a negative potential with respect to ground when the current due to detection flows in the circuit. The amplitude of the negative voltage depends upon the strength of the incoming signal. When the incoming signal is strong, a large negative voltage will be developed at the point where the 1.25-megohm resistor is connected, because a large detected current will flow through the detector circuit. When the signal is weak the negative voltage will be small.

The voltage developed by the AVC circuit is used as a grid bias in the IF amplifier circuit and is sometimes connected to the RF amplifier grid return circuit. When the negative bias is increased on the grid of an IF or RF amplifier, the gain of the stage will decrease. This means that the gain of the IF or RF amplifier will increase when the signal is weak and will decrease when the signal is strong, thus giving an automatic control of volume.

FIGURE 5. Diode detector, 1st audio and AVC.



SEPTEMBER QUESTIONS

1. Why is a superhet better than a T. R. F.?

2. Why is AVC used?

The answers to these questions will appear in the next issue.

Presenting: Mike Berkowitz

Career Encompasses Entire Motion Picture History

THE "presentation" of Mike Berkowitz in the limited space available herein is almost a mockery of the career of a man whose experience as designer, expert machinist and projectionist encompasses the entire history of the motion picture business. Strange it is that a man of Mike's stature in the film world should have received so little recognition, even at the hands of those who are familiar with his many outstanding contributions to the art.

The Berkowitz saga began in Odessa, Russia, where he was born in 1874. The alacrity with which Mike subscribes to this date lends color to the suspicion of his friends that he is indulging in a bit of self-cheating for, say, a year—or two—or three. . . . Anyhow, Mike vows that he was 12 years old when he landed in America in 1886. Almost immediately he got a job in a brass factory, wherein he soon became an expert finisher.

One nippy late-Fall day in 1890 Mike, with obvious acquisitiveness, was peering into a Bowery pawnbroker's window at a long-yearned-for watch when, responding to a tap on the shoulder, he turned to be confronted by a man, obviously a "foreigner," who articulated in a meaningless jumble of French and English. Mike finally caught the phrase "moving pictures," which he understood as an offer of a job of toting pictures on his back. Finally, however, the Frenchman overcame Mike's outraged sense of mechanical craftsmanship by conveying the idea, illustrated by fluent hand-designs on the store window, that he wished him to operate a machine that showed pictures. The salary was $12 weekly—very big money in 1890—and Mike promptly forgot about the brass factory.

Mike had a really tough time getting started on his new job because both he and the Frenchman knew only how to murder the English language. But he soon learned how to operate the then strange mechanism. Shows were given in a Bowery place known as the Gaiety

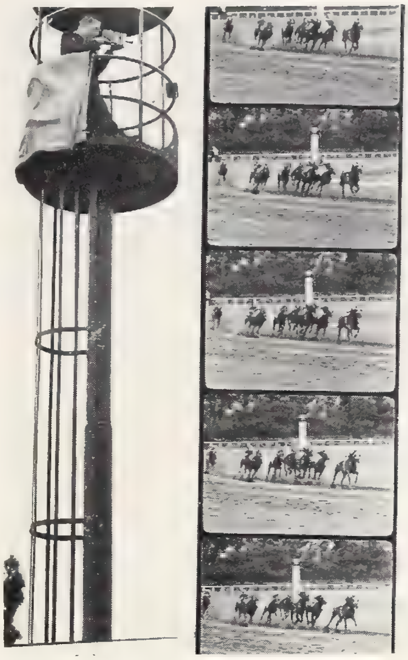
(Continued on page 26)

Telefilm Race Track Control

LESS than a year ago a group of Hollywood cameramen of the veteran, hard-bitten type, who had shot newsreel stuff all over the world and on every war front, pooled their ideas and launched what looms as a new million dollar phase of the motion picture industry. This movie innovation, known as Telefilm Control, consists of taking 16-mm films of horse races, their speedy development within seven minutes after taking, and immediate showing to track stewards and judges.

First tried at Hollywood Park in California the system has rapidly gained favor and is now in use at Pimlico, Suffolk Downs, Arlington Park and Washington Park. So enthusiastic about Telefilm results is the California Horse Racing Board that it has ordered its use at all major California tracks.

In this new control system six towers, ranging up to 40 feet in height, are erected around the track. In each tower is a cameraman with an electric-motored telescopic camera. Head-on pictures are taken in 16-mm of every phase of the race. These films are picked up and rushed to a darkroom under the grandstand where they are quickly developed and dried by means of a secret Telefilm process.



Telefilm cameraman atop a specially constructed steel tower on grandstand roof shooting the progress of a race. Developed film strip at right, is shown ready for projection.

7-Minute Developing Time

This developing process is one of the system's great advantages, because if there is any inquiry about the conduct of any phase of a race, the pictorial record is ready for projection within 8 minutes after the race ends. Even better time has been established for developing (one race record was readied in less than 7 minutes recently at Suffolk Downs), but 8 minutes is the average.

The 16-mm Telefilm cameras catch every movement of horse and riders throughout the complete race distance—records in closeup that which the eye does not see. Rules infractions are plainly visible; and in many instances the films absolve jockeys of blame in charges of rough riding.

"Jack Mackenzie, general manager of Hollywood Park, deserves much credit for the idea," states Joseph A. Thomas, president of Telefilm Studios. "Mackenzie thought it would increase public confidence as well as tend to put the jockeys on good behavior if everybody knew a camera was trained on every move the riders made. He first tried shooting film from the top of the grandstand with a long-range telescopic camera, but it didn't work.

"When Mackenzie first approached me I promptly got together some of Hollywood's veteran newsreel cameramen, secure in the knowledge that if those boys couldn't figure out a workable system nobody could. Just how good a job the boys did is now history."

The first season at Hollywood Park under Telefilm Control was the cleanest racing program in history, fewer fouls being claimed than ever before. Moreover, those claims of foul that were pressed were quickly decided with a square deal to all concerned. Incidentally, each step of the Telefilm process is handled by I. A. men, from the camerawork through to projection.

Race stewards and technical personnel viewing race film which has been developed, printed and projected in special room under the grandstand within 8 minutes after finish of race.

Film Technique Courses in 120 Colleges, Says SMPE

MORE than 100 courses in various phases of motion pictures were given by American colleges and universities in the past year it is shown in a survey made by an S.M.P.E. committee. Although the teaching of film subjects is on the increase, the Committee points out that few, if any, of the courses to date can be construed as offering technical information on a level corresponding to that of other well-established curricula. Most of the courses come under the broad heading of visual education.

Subjects listed include cinematography, sound recording, film editing, projection, distribution, economic problems in exhibition, film processing and other topics. Some of the courses include the actual making of films, which involves the artistic as well as the technological aspects of motion picture making, says the report, and students taking these courses "obtain a certain familiarity with motion picture equipment, especially of the 16-mm variety, but it is doubtful that any basic training in cinematography or sound recording is included in these visual education courses.

Labor Union Aid Sought

The Society plans to institute genuine basic courses embracing film technology in institutions of higher learning. It is felt that the industry has advanced to a point where training for this field should be recognized as calling for special instruction. Specific courses leading to a degree in the important field of sound recording are recommended.

The failure to train young men and women for movie positions the Committee says, reflects the reported difficulty of school graduates in finding employment in the studios "due to rigid closed shop conditions." The cooperation of labor unions will be sought by the Society.

INDUSTRY'S SAFETY PROGRAM

(*Continued from page 14*)

flameproofing is thoroughly done, whether by the theatre staff or by some outside contractor. The points to make certain of are: selection of first-class flameproofing chemicals; assurance that all parts of the fabric are treated; assurance that sufficient chemical is used so that the material is thoroughly impregnated. Labor or cost should be disregarded, the important purpose being to do a good job of flameproofing.

The question often arises as to the procedure in fighting a projection room fire. Much consideration has been given to this question by projectionists, theatre operators, the Underwriters, the Projection Practice Committee of the Society of Motion Picture Engineers, and others, and the best opinion is that the projectionist should close the room shutters and immediately leave the room, closing the door behind him. This presupposes that the various safety devices are in working order. This last is the responsibility of the projectionist.

Novel Industrial Safety Pattern

In the distribution of motion pictures, we believe that we have set a pattern for all industry. Our industry for more than twenty years has had its own fire and safety inspection organization comprising men employed by the industry itself who travel the country constantly inspecting motion picture film exchanges. In addition, there is a committee in each city made up of representatives of several companies who inspect exchanges. Thus we have one company inspecting the other company's property—truly a situation to promote competition for greater safety. No other industry does anything like this.

Figures just released, covering some 250 exchanges where this service is in effect and located in 31 cities, indicate that the fire losses have amounted to less than $5,000 over a period of twenty years. No industry of any kind in the United States can equal this record.

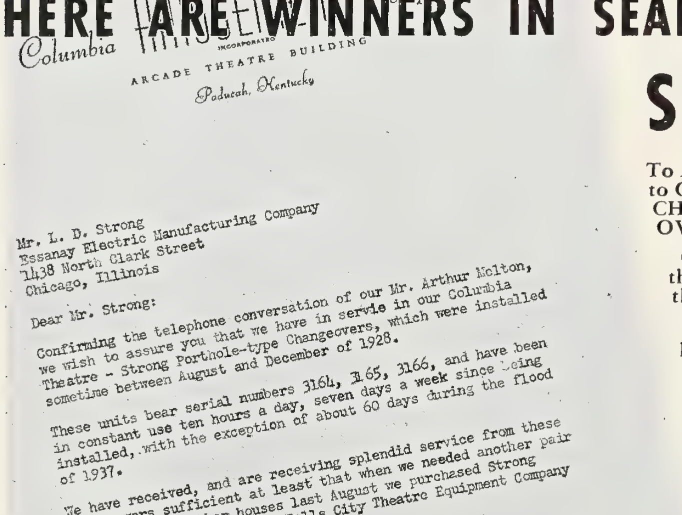
All portions of an exchange where film is handled are equipped with automatic sprinklers. Rooms are cut off from one another by fire doors that close automatically at time of fire. The vaults are designed with special sprinkler systems, double fire doors, and an automatic vent which will open at time of fire. We have adopted any devices that the Underwriters or others can design which will measurably increase the safety of our exchanges. The human element is the greatest source of danger, but the record tells the story, and exchange employes have played an important part in making the record. Astronomical amounts of film are handled daily without mishap.

In our studios we face an entirely different type of problem from that in theatres or exchanges. Here we do have a number of mechanical devices—but safeguarding in this case, however, workers.

Safety Must be 'Sold' Individually

We have made many studies, experiments and trials, and have found that the only successful manner in which safety can be attained is by having safety sold to the entire organization. It cannot come from the top down only. Nor can we reach every man at the bottom only. It must

(*Continued on page 29*)



Columbia Amusement Company Incorporated
ARCADE THEATRE BUILDING
Paducah, Kentucky

Mr. L. D. Strong
Essanay Electric Manufacturing Company
1438 North Clark Street
Chicago, Illinois

Dear Mr. Strong:

Confirming the telephone conversation of our Mr. Arthur Melton, we wish to assure you that we have in servie in our Columbia Theatre - Strong Porthole-type Changeovers, which were installed sometime between August and December of 1928.

These units bear serial numbers 3164, 3165, 3166, and have been in constant use ten hours a day, seven days a week since being installed, with the exception of about 60 days during the flood of 1937.

We have received, and are receiving splendid service from these changeovers sufficient at least that when we needed another pair for one of our other houses last August we purchased Strong Zipper Changeovers through Falls City Theatre Equipment Company of Louisville, Kentucky.

COLUMBIA AMUSEMENT COMPANY
R. H. Overstreet
R. H. Overstreet,
Manager

RHO:as

Subscribed and sworn to before me this 27th of August, 1946
Elaine Dale
Notary Public, McCracken County, Ky.
My Commission Expires December 21, 1949

SOUND-REPRODUCING UNITS

(*Continued from page 12*)

they were discarded in favor of the actual gain figures listed in current bulletins. However, these earlier figures were quite suitable for field tests. To the foregoing gain figures the 60 c.p.s. correction factor should be added.

In order to determine the frequency characteristics of these amplifiers, an oscillator is required. Since the gain has already been determined by practical means, the oscillator output is adjusted to 60 c.p.s. and connected to the film amplifier under test through a 10-megohm resistor. Adjust the oscillator output level until a V.I. reading similar to that obtained with the former signal source is obtained at amplifier output.

Oscillator Output Level

Maintain this oscillator output level at all test frequencies and note signal variations at amplifier output. These variations, when compared with the reference frequency, denote the frequency response of the amplifier under simulated normal working conditions.

It will be found, providing reasonably short leads are used, that the frequency response of these amplifiers will closely follow those given in the equipment bulletins—that is, if the amplifier is all right.

It may be noted, if very short leads are used and the 10-megohm resistor omitted, that these amplifiers are practically flat from 60 to 10,000 c.p.s.

Tele Broadcasters' Assoc. Meet in N. Y., Oct. 10-11

Television Broadcasters Association, Inc., has announced the Second Television Conference and Exhibition at the Waldorf-Astoria Hotel, N. Y. City, on October 10 and 11. The two-day event is open to all interested persons and will bring together persons and organizations from all fields sharing interest in the progress of television.

Blanket registration fee of $25 will include admittance to all general sessions and panel meetings, all exhibits, two luncheons, the banquet and cocktail party, as well as a transcript of all proceedings. Reservations may be directed to the Association at Suite 1038, 500 Fifth Ave., N. Y. City, 18.

The Conference date coincides with the date announced for the introduction of major-company tele receivers, thus a fine exhibit is assured.

New Bausch & Lomb Plant

Increased manufacturing demands have forced Bausch & Lomb Optical Co. to acquire a new plant in Wellsville, N. Y., 90 miles south of the main plant in Rochester. Initial production schedules, utilizing principally women workers, center on light manufacturing, with 30 more workers being added each month to a total number of several hundred.

PRESENTING: MIKE BERKOWITZ

(*Continued from page 22*)

Museum, which effete name belied the basic roughness of the place. In short, a joint.

Mike's First Projection Setup

The film used was made in France and was about 50-mm wide, Mike recalls. It was in 100-ft. sections, being run at the very slow pace of 25 feet per minute. The projector, of the Frenchman's own design and manufacture, weighed about 25 pounds, had no upper sprocket, and employed a hand-fed carbon arc. No film magazines were available, of course, and Mike rigged up a bag as a crude receptacle. An ordinary bedsheet served as the screen.

Everything went well for a while and young Berkowitz waxed opulent on his munificent $12 weekly, a sizzling pace for a 16-year old. Then one day the Frenchman, obviously greatly excited, rushed into the Museum, hurriedly packed his gear, made his adieus, and took off—to Philadelphia, Mike thinks. Seems that Uncle Sam was extremely interested in Frenchie's immigrant status.

Mike thereafter neither saw nor heard of his French employer nor does he recall his name—if, in fact, he ever knew it. Mike regrets keenly that he was not more inquisitive concerning the Frenchman's background, no less than about the origin of the projector and the film that was used, because there isn't the slightest doubt that his employer, the equipment and the film are of terrific importance to the history of the motion picture. It must be remembered that this incident antedated by several years the appearance of the first Edison projector and film, popularly but erroneously credited with having launched the art of motion pictures.

Mike recalls that this old projector, with all its obvious faults, reflected a competent understanding of the requisites for motion picture projection, his surmise being that the original model probably was produced in Germany.

So it was back to the brass factory for Mike, and there he stayed until 1894. Then destiny intervened in the person of Al Harstyn, pioneer motion picture man and, incidentally, a cousin of Mike's. Harstyn obtained a job for Mike at the Vitagraph plant at 16 Nassau St., New York City, which was producing the Vitagraph projector. Mike was engaged to operate a foot-power lathe.

Association with Frank Cannock

Mike quickly won the fancy of Vitagraph's chief machinist and "operator," and thus was sealed by enduring friendship a combine that not only determined the course of Mike's life but also was to exert a profound influence on the technological development of motion picture reproduction. The name of Mike's newfound friend was Francis (Frank) B. Cannock.

Cannock's wizardry in mechanics is perhaps best described by his statement that "The requirements of machine fitting place the thousandth-of-an-inch as the limit of latitude; on important parts a ten-tousandth is the requirement." The contributions of this genius to the motion picture art have been described in detail in a recent issue of I. P.[1]

Mike was in execllent hands, for Cannock infected him with his passion for only the finest mechanical work and also taught him the art of good projection. Soon Mike was running a Vitagraph projector on his own at Inman's Cafe, Coney Island. (Motion pictures and saloons were seemingly inseparable in those days.) One of the films was the Corbett-Fitzsimmons fight.

Following the Coney Island stand, Mike turned down a Vitagraph road job because his English still was as remote from intelligibility as was Odessa from New York. Instead he became an "operator" at the Eden Musee, famed showhouse which is accurately referred to as the birthplace of the motion picture theatre, where Cannock was chief operator.

But Cannock had much larger fish to bake. Enlisting the aid of Mike, Cannock designed and built in rapid succession the Cinematograph and the Edengraph projectors. The duo then pulled off their greatest coup—the design and manufac-

[1] "Case History of the Simplex Projector," by Mark Stephan, I. P. for July, 1946, (Section 2), p. 33.

ture of the first Simplex projector. Mike recalls vividly that practically all the discussions and designing incident to this job took place in the back room of O'Keefe's saloon at 42nd St. and Vanderbilt Ave., New York City, the preliminary drawings being sketched out on the back of menu cards. The influence of the saloon on the budding film industry persisted.

Being in rather deep water, the boys anxiously awaited an "angel" in the form of fresh money. The latter was forthcoming through the aid of another historic industry figure, Edwin S. Porter, later to become president of Precision Machine Co. Porter, in turn, enlisted the support of another figure not entirely unknown on the national scene, James A. Stillman of the National City Bank. Thus was effected the marriage of brains and money that ultimately swamped the Powers projector and laid the basis for the modern Simplex mechanism.

Only the irony of fate robbed Mike Berkowitz of just recompense for his contributions to the making of the Simplex projector, the first models of which appeared in 1909. Mike was not a direct participant in the deal that set up the Precision Company, his interest being via the indirect route of his strong friendship with Cannock. The latter's untimely passing was the decisive factor in charting Mike's future life as a projectionist and expert mechanic, as contrasted with the probability of his being a wealthy manufacturing company executive.

Many Years in Supply Field

Mike's career since 1910 appears rather anti-climactic by comparison with the momentous events of the preceding years. For almost ten years thereafter he operated his own expert machining shop in downtown New York City, foresaking this enterprise to join Howell's Cine Co., presided over by Joe Hornstein, who still is active in the supply field. Howell's was absorbed by the National Theatre Supply Co., and Mike worked for the latter outfit until 1930.

About this time the Warner Brothers, flushed with their smashing Vitaphone triumph, enlisted Mike's services in turning out a wide-film projector. Mike produced the 65-mm Vitascope, which also could handle 35-mm film, the fine mechanical features of which may be adequately described only in a separate story.

Along about 1930 Mike seemingly completed the circuit when he joined the projection staff of the Capitol Theatre on Broadway. And there he is today. But his mechanical bent remained unrequited, so he upped and established a machine shop which today turns out so classy a job of repairing and rebuilding projectors and related equipment that it has to decline hundreds of orders annually.

This machine shop evokes one bit of humor. Mike had the bad judgment to break-in his son, Milton, both as a projectionist and a machinist, with continual

harping on the requisites for mechanical perfection that had been absorbed from Cannock, the perfectionist. Mike now relates gleefully how his son looks critically at some of Mike's work and intimates that it could be a trifle better.

As a charter member of I. A. Local 306 Mike has held many important union offices and is today chairman of the old-age pension board. And, of course, Mike is the perennial president of the famed 25-30 Club of New York City which numbers among its members pioneer projection men from all over the U. S. and Canada.

Mike may never get suitable recognition for his magnificent contributions to motion picture technology, certainly not through the medium of a grouping of words such as this, but a mighty chorus in the form of thousands of projectors whirring endlessly on all over the world will ever attest to his craftsmanship. Doff your toppers, boys.

S.M.P.E. 60th Convention in Hollywood, Oct. 21-25

PLANS for the 60th semi-annual convention of the Society of Motion Picture Engineers, to be held October 21-25 inclusive at the Hollywood-Roosevelt Hotel, have been concluded by William (Bill) Kunzmann, perpetual convention chairman. Daytime technical sessions will be held at the hotel, with evening sessions slated for "on location," including several of the major studios.

A large proportion of the technical papers to be presented at the convention have already been scheduled, but all those who wish to appear on the program, and who submitted an abstract of their paper prior to September 1, must forward complete manuscripts on or before October 1 to either Dr. C. R. Daily, Paramount Studios, 5451 Marathon St., Hollywood, or Barton Kreuzer at RCA Victor, Camden, N. J.

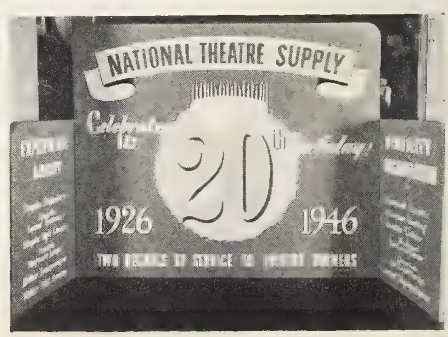
Because of the critical housing shortage in Hollywood, all those wishing to attend the convention are urged by Mr. Kunzmann to book their accommodations immediately direct with Stewart R. Hathaway, manager of the hotel. The Society's Pacific Coast Section has set up a committee headed by Herb Griffin to provide as far as possible for those who experience difficulty in obtaining hotel accommodations.

8 Technical Awards Slated

The convention will open with the traditional get-together luncheon on Monday, October 21, at 12:30 p. m., the guest of honor and speaker at which will be an outstanding industry figure whose identity will be announced later. Technical sessions will get underway immediately following the luncheon.

A highlight of the convention will be the awarding of citations for outstanding achievement in the field of sound motion pictures, with eight such awards scheduled to be given to Dr. Lee DeForest, 20-Fox Film Corp., Bell Telephone Laboratories, Western Electric Co., General Electric Co., Westinghouse Electric Co., M-G-M Pictures Corp., and RCA Victor Co. These presentations will wind up the industry's observance of the 20th anniversary of sound motion pictures.

Evidence of the steadily increasing prestige of the Society is had in the announcement that 430 new members have been added in the first eight months of 1946, bringing the total Society membership to an all-time peak of 2,359, with applications continuing to come in from both the domestic and foreign fields at an unprecedented rate.



Typical example of promotional material used by National Theatre Supply Co.'s 28 branches to mark the 20th anniversary of the founding of this nationwide theatre equipment supply company.

INDUSTRY'S SAFETY PROGRAM

(Continued from page 24)

extend from the top down and the bottom up. The key man, however, is the foreman or supervisor, the man who is actually responsible for a comparatively small group of men. He can observe them at their daily task, and by education and close supervision keep them from injuring themselves or their fellow-workmen. Safety engineers know that a high percentage—estimates run as high as 90%—of accidents are caused by carelessness.

As indicated previously, people need not so much to be told as to be reminded. The foreman is the man who by a word here and there can keep his men reminded and prevent accidents with their resultant suffering. Throughout our industry we have set up intelligent safeguards. The human element is our chief danger. Every man in the industry, whether he knows it or not, is a link in the chain. It is up to him individually to do his part.

The motion picture industry has a tradition of intelligent, comprehensive and cooperative safety endeavor, of which we may well be proud. Carry on!

BOOKS RECEIVED

OKAY FOR SOUND! edited by Frederick M. Thrasher. 303 pp., profusely illustrated, buckram binding, 8½ x 11. Duell, Sloan and Pearce, New York; $3.75.

This ambitious effort attempts to tell the story of how the motion picture found its voice. Profusely illustrated, "Okay for Sound!" places heavy reliance upon the picture-caption technique to get its message across—which, after all, is not such a bad idea considering the subject matter.

One cannot escape the impression that this book is a panegyric for the brothers Warner, tied in somehow with the current observance of the 20th anniversary of sound pictures. Practically all the stills used are from the Warner file, and a great deal of the copy is devoted to the Warner-Western Electric fusion. Important contributions these two companies did make to sound pictures, of course, but the truth of the matter is that many minds and many hands, not accorded mention herein, contributed mightily to the development of the sound recording and reproduction art.

For example, the now familiar myths anent Edison's contribution to the making and the projection of silent movies, no less than his fancied chores in the sound-on-film field, are repeated herein. Vastly more important was the work of men such as Eugene Lauste, Louis Le Prince, W. K. Laurie Dickson and, last but certainly not least, Lee DeForest. The work done on the contributions of these men, while important, was strictly of a refining nature.

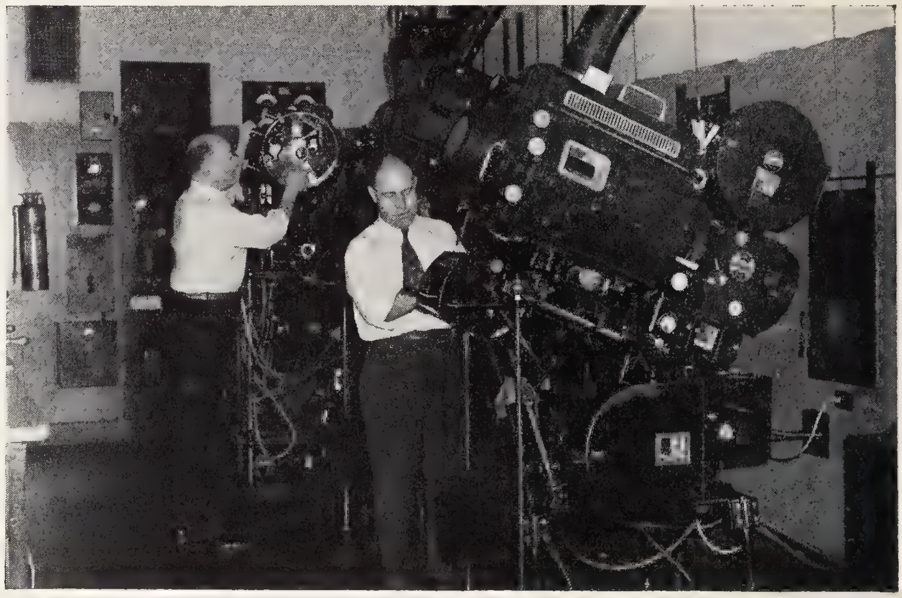
The Warner brothers certainly displayed both nerve and verve when they pushed through the Vitaphone development 20 years ago, but it is a well-known fact that it was either swim with Vitaphone or sink with the Warner silent films of that era.

Apart from the aforementioned inadequacies, "Okay for Sound!" represents a mildly interesting commentary on the progressive development of motion pictures from their early beginning down to and through the sound-picture phase to the training films of the war years and the documentary, industrial and educational pictures of today. But one shouldn't confuse this contribution to the literature of the art with history—not because of what it contains so much as for that which it omits.

Series I SNAPLITE

f/2.0 Series II SNAPLITE

L. U. 466 Demonstrates 'Projection a Specialized Art'



THE man that nobody knows, Mr. Projectionist, was stripped of his anonymity and laid bare for public inspection by means of a smashing five-column feature article that appeared in the amusement section of the Fort Wayne (Indiana) Journal-Gazette a few weeks ago. Profusely illustrated and packed with projection details, the article served to dispel the foggy notion that modern theatre sound-picture reproduction requires only a well-oiled mechanical contrivance.

In fact, the Journal-Gazette article was noteworthy for its emphasis upon the vital importance of the human element in the projection process and the varied knowledge required of the truly professional projectionist. Stress was laid upon the fact that the most costly equipment, the most elaborate projection room and the smartest theatre decor—no less than every step of the preceding production process—all go for naught without the know-how and showmanship of the projectionist.

Particular stress was laid upon the necessity for split-second timing in achieving a smooth-flowing feature presentation, and frequent reference was made to the on-his-toes alertness required of the projectionist.

Featured prominently in the newspaper yarn were Randolph P. Stanton, president, and Richard H. Schiefer, member, of Local 466, who are shown in the accompanying picture of the Paramount Theatre projection room.

IN THE SPOTLIGHT

(*Continued from page 19*)

that several of the association members refused to accept this increase and are negotiating individually with the local.

● Among the delegates present at the recent I. A. convention were not a few who were also delegates to the 1915 Chicago convention—Harry Abbott, New York Local 1; Jack Warner, Milwaukee Local 18; John J. Russell, Toledo Local 24; Steve Newman, then representing Salt Lake City Local 99; Ed Pye, Galveston Local 65; Ed Lother, Birmingham Local 78; Phil Lipman, Montgomery Local 92; Jack Hauser, Worcester Local 96; Harry Engle, Schenectady Local 139; Sam Isaacson, Baltimore Local 181; Murry P. Smyth, Beaumont Local 183; Charlie Strong, Lansing Local 274; Edwin G. Hess, York Local 283; Harry Mackler, New York Local 306; J. R. Marksbury, Sioux City Local 355, and Joe Steadman, Youngstown Local 388.

● We missed the faces of many oldtimers, some of whom have passed on and others who were unable to attend. Among those oldtimers who were unable to make the convention this year are Bill Canavan, former I. A. president; Barney Ryan, Pete J. Ryan, Dick Green, Charlie Crickmore, Charlie Schlegel, Lou Krouse, Germain Quinn, Roy Stephenson, Claude L. Hagen, Ben Brown, Pasty Johnson, Dave Berk and Bill Lang.

Others, who passed on, are Charlie Shay, Jim Lemke, Pat Barry, Lee M. Hart, (former I. A. presidents; Phil Kelly, Frank G. Lemaster, Jake Ullrich, Pat Maloney, John Fanning, Oscar Scheck, Mike Carney, Bill Monroe, Jim McGrath, John Alf, Ernie Clark, Ben Connolly, Ralph Behling, John Suarez, Bill Pringle, Fred Dempsey, John Barry, Marty Higgins, Harry Dignam, Les Dolliver, Harry L. Spencer, Bill Dillon, Ed Tinney, Mike Kelly, Charlie Bonn, John C. Williams, W. D. B. Wiggins, Charlie Randall, John Skinner, Bill Harrer, Tom Trundle, John Riley, Harry Griffin, Max Ruben, and a host of others too numerous to mention herein.

● Jack Hauser, business agent for Local 96, Worcester, Mass., and delegate to the I. A. convention, also acted as correspondent for the Worcester Labor News, reporting convention activities.

● The first I. A. convention attended by International President Dick Walsh was held in Cleveland, 1926, where he was sent as a delegate from Brooklyn Local 4. Since then he has attended every convention.

● Cincinnati Local 327 was well represented at the recent I. A. convention. In addition to the official delegates, John E. Krebs and Gale Murney, the following members of the Cincinnati local attended the convention: Howard Shelton, William Strome, George Buquo, Charlie Ring, Cliff Newman, Thomas Moran, Edward Altvater, George Krebs, and a film worker named Charlie Goodwin. These men were unanimous in their praise of the Chicago Convention Committee members, and for committee chairman Gene Atkinson in particular, for the splendid manner in which convention matters were handled.

● From reliable sources we learned that motion pictures will once more be shown on ships when they are returned to the private shipping lines. We were advised

by the Grace Line that it expects to take over its ships within the next four months and will show pictures thereon. The pay for projectionists on this line will be $350 per month, plus keep. The projectionist, however, must pass an examination as assistant electrician and be in possession of ships' papers. Since all ship employes are unionized, it should not be too difficult a matter for our union officials to man them with union projectionists.

Cinecolor Now Rated as a Formidable Factor

FOR the first time a serious competitor to Technicolor has gotten a foothold in the film industry, according to a recent feature story in *The New York Times.* Actually, the competing company, Cinecolor, was established in 1932 and eked out a precarious existence for ten years, finally going into voluntary bankruptcy in 1942. At the end of 1943 Cinecolor's shares were on the market at 4 cents apiece or 96 cents under par.

Then a change began, continues the *Times.* The increasing demand for color in commercial films gave the company business, and in 1944 Cinecolor processed a $35,000 independent feature production, "Wildfire," and two equally modest Spanish-language ventures. In October, 1944, the company managed to emerge from bankruptcy with all creditors paid in full, and by May, 1945, the market quotation on Cinecolor shares had risen to their $1 par. In January, 1946, the stock had jumped to $6, and it is now hovering at about $8.50.

Factors Effecting Improvement

Aside from a fiscal reorganization of the company, two factors caused the improvement in Cinecolor's position. First, Producers Releasing Corp. filmed "Enchanted Forest" and "Song of Old Wyoming" in Cinecolor, early in 1945, and Metro-Goldwyn-Mayer adopted the process for "Gallant Bess" with success at the end of the same year.

As a result, eight features have been photographed in Cinecolor since, two for Universal, three for Hal Roach, one for United Artists, one for P. R. C. and one for Golden Gate. Cinecolor's immediate commitments include films at Columbia, Paramount, Eagle-Lion, Hal Roach and Golden Gate.

The second factor is the prospect that Technicolor may lose exclusive control of the three-color monopack process. Except in cartoon photography, Cinecolor is confined to two basic colors, red and blue; while Technicolor, because of patent agreements, holds a monopoly in the three-color field. Without investing heavily in special cameras, Cinecolor cannot use three colors for live action unless the monopack process becomes generally available. Its present two-color process requires only a small adaptor on a regulation camera.

Cinecolor's Low Production Cost

Cinecolor is able to compete with Technicolor even without the monopack, however, because its process is peculiarly suitable to outdoor photography, and because its fee is only 4.5 cents per foot of film, while Technicolor charges 5.97 cents a foot. Cinecolor's service charges are also lower than Technicolor's, and the cost differential on a standard feature will exceed $50,000 by the time prints have been made, an important sum for a low-budget picture.

Cinecolor showed a loss of $25,000 for the year ending September, 1945, but the management has predicted that the fiscal year, ending this month, will show a profit and has embarked on an expansion program to permit the processing of 100,000,000 feet of film per year, which will equal more than half of Technicolor's present annual capacity.

Some Historic Firsts: The Vacuum-Tube Voltmeter

TECHNICAL STAFF, BELL TELEPHONE LABORATORIES

BY 1915, instruments for measuring d.c. voltage were very satisfactory, and were available in a wide variety of forms. Instruments for measuring a.c. voltage at frequencies used in the power field were also available, although perhaps not quite so satisfactory as the d.c. instruments.

Measurements of voltage at high frequencies, however, were much more difficult to make. Hot-wire or electrostatic types of instruments were generally required, and these lacked the simplicity and practical precision of the electrodynamic meters except under controlled laboratory conditions. Careful calibration was required before dependable readings could be obtained.

Patent Application Sept. 1915

A disadvantage of practically all types of commercial voltage-measuring devices was that they drew appreciable current from the source being measured. Since most of the high-frequency voltage measurements were made on circuits of high impedance, even the small current taken by the measuring instrument disturbed the circuit and affected the accuracy of the reading.

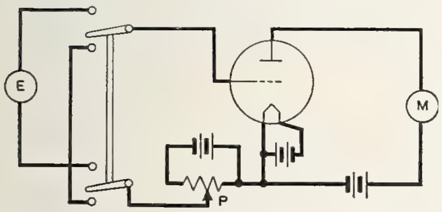


FIGURE 1

At that time, R. A. Heising was actively engaged in radiotelephone developments, and was badly in need of an instrument that would easily and accurately measure voltages at the radio frequencies. The high-vacuum electronic tube had recently been developed by Arnold and had been employed for transcontinental wire telephony.

Heising's familiarity with the characteristics of this tube enabled him to perceive that it could be adapted to the measurement of voltage, and in Sepember, 1915, he applied for a patent on a thermionic voltmeter. Patent No. 1,232,-919 covering such a device was issued in 1917, and reissued in 1922. Since that time, the vacuum-tube voltmeter has become probably the most widely employed instrument in the radio field. With the development of carrier transmission, and the widespread application of higher frequencies to wire communication, the field of the vacuum-tube voltmeter was further broadened, and today it is indispensable in all electrical communication work.

When the grid of a three-element vacuum tube is negative, no appreciable current will flow in a circuit connected between the grid and the filament. Expressed in another way, the impedance across the grid and cathode under these conditions is extremely high—infinitely high in the ideal case. Moreover, when the grid is sufficiently negative, no current will flow in the plate circuit either; and with any value of grid voltage, the current that flows in the plate circuit is unidirectional, and thus may be measured with a simple d.c. meter. These are the characteristics that Heising took advantage of in inventing the vacuum-tube voltmeter.

Actual Measuring Procedure

With the circuit shown in Fig. 1, E is the source of voltage to be measured, and P is a potentiometer with which any desired percentage of the battery voltage may be applied to the input circuit. The potentiometer may be given a calibrated scale so that the applied voltage may be read directly.

To make a measurement of voltage, the switch at the left is first moved to the lower position, and the potentiometer is turned until the meter M just shows zero current. The switch is then moved to the upper position. If E is an alternating voltage, the current that flows in the plate circuit is related to the average value of the positive half-cycles. The potentiometer is now moved until

• PERSONNEL •

Altec Service Corp. changes effective immediately are: F. M. Mewborn as branch manager of Seattle district and G. E. Wiltse as branch manager of Dallas district.

• • •

Jimmy Frank, manager of the National Theatre Supply branch in N. Y. City and a top-notch cookie technically, has returned

from Los Angeles where he was elected president of Zeta Beta Tau, national fraternity with 35 chapters. Jimmy "went" ZBT back in 1924 when he was a frosh in Sheffield Scientific School at dear old Yale.

• • •

Earle G. Hines, head of Precision Equipment Corp. which has 13 subsidiary companies including several film equipment plants, is nearing the end of a long stay at the Beverly-Wilshire Hotel, Hollywood.

• • •

Theodore A. Smith has been named general sales manager of the Engineering Products Dept. of RCA. A graduate of Stevens Tech, Mr. Smith joined RCA in 1925, since which year he has been active in the television engineering field as well as in the sales of broadcast equipment.

• • •

The greatly accelerated pace of the 16-mm field is reflected in recent personnel additions to the Ampro Corp. staff as follows: Ralph H. Knutson to the export section; Howard Marx as assistant to the sales manager, and Gene F. Swepston to the education section.

• • •

Major Bob Merchant, only recently returned to Altec's Cincinnati district as an inspector after four years in the armed forces, has been recalled to active military duty at Oak Ridge, Tenn., site of the atom bomb development.

I. A. ELECTIONS

LOCAL 38, DETROIT, MICH.

E. Clyde Adler, *pres.;* Clarence Apgar, *vice-pres.;* Lee Hamilton, *rec.-sec.;* George Cornwallis, *cor.-sec.;* Jerry (Red) Bric, *bus. agent.*

LOCAL 168, VICTORIA, CAN.

Fred Martin, *pres.;* Al Riches, *vice-pres.;* Stanley Barwick, *sec.;* William More, *treas.;* William Campbell, *bus. agent.*

LOCAL 232, NORTHAMPTON, MASS.

Edward Daley, *pres.;* Joe A. Snape, *vice-pres.;* Daniel H. Schwartz, *sec.-treas.;* Talbot Peterson, *bus. agent;* John Tichy, *exec. board;* Frank Pietraskiewicz, *sgt.-at-arms.*

LOCAL 369, HUNTINGTON, W. VA.

Sherman T. Gallimore, *pres.;* George Snead, *vice-pres.;* Charles A. Vogel, *sec.;* O. Rose, *treas.;* Sam Hunter, *bus. agent.*

LOCAL 576, MANSFIELD, OHIO

John K. Deyarmon, *pres.;* Howard McAllister, *vice-pres.;* D. A. Guthrie, *sec.;* Howard Straub, *treas.;* A. F. Esbenshade, *bus. agent.*

New DeVry Speaker Unit for Drive-In Shows

DeVry has just announced a new, compact and highly efficient individual speaker for drive-in theatres. The unit, comprising two separate 5-inch permanent magnet speakers, each mounted in a rugged, waterproof metal

housing and a central terminal box, was designed and built expressly for permanent installation on a car-parking ramp.

One speaker is mounted on either side of the terminal box within easy reach of patrons from their car windows and is readily attached directly to either the car window or sun visor during the show. Each speaker has its own adjustable volume control. These speakers have undergone exhaustive tests under more adverse weather conditions than will be encountered in actual operation.

Anent "Stellite" Reflectors

SEVERAL recent letters to I. P. inquire as to the practicability of using as projection arc lamp reflectors the Stellite mirrors which found such extensive use in Navy searchlight work during the recent war. The outstanding characteristic of these Stellite reflectors is their superlative resistance to salt water, and it is for this one characteristic that this particular alloy was so valuable to the Navy.

These Stellite mirrors are not of particularly high reflecting power; in fact, metal mirrors having much higher reflectivity could be produced and would be satisfactory for motion picture projection.

Overall, however, no metal mirrors satisfactory in all other respects can have the high reflectivity of a silvered glass mirror.—ED.

once again the meter indicates zero current. Under these conditions, the peak value of the a.c. voltage is just equal to the difference between the two settings of the potentiometer. Had E been a d.c. voltage, an identical procedure would have been followed.

This circuit illustrates only one of many ways in which the vacuum tube may be used for measuring voltage, and other ways were indicated in Heising's patent. The basic principle claimed is that of balancing the voltage to be measured by an adjustable known voltage in the input circuit of a thermionic rectifier, the condition of balance being ascertained from a current-indicating instrument in the output circuit.

This fruitful suggestion for a method of measuring voltage, either d.c. or a.c. of any frequency, without taking current from the measured source and without requiring preliminary calibration, has proven indispensable in developing radio and other communication circuits ever since that time. Today, commercial vacuum-tube voltmeters are available in a wide variety of forms, and no laboratory is without them.

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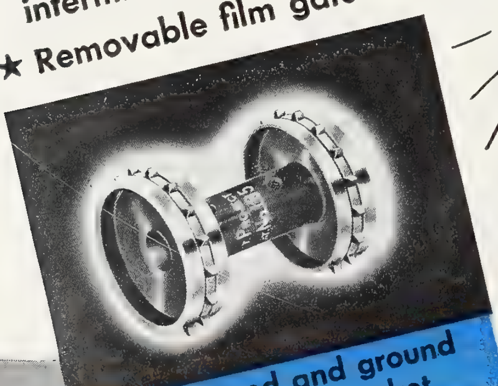

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- ★ Removable film trap
- ★ Automatic fire shutter trip

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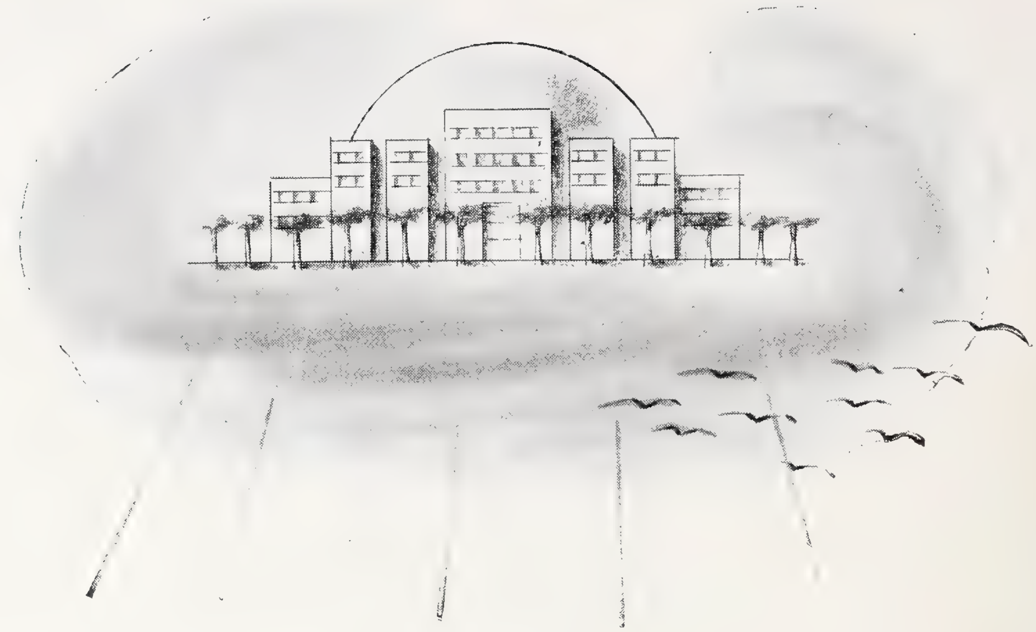

Dream Hospital...

The hospital depicted here exists only in the hearts of men and women who are losing the grim battle with cancer. And in the imagination of other men and women who want desperately to provide a haven for these victims in need of hope and care to sustain them in the few months or years still remaining to them.

Actually, there is not a single such hospital anywhere devoted exclusively to these unfortunates who *may* be beyond the help of medical sciences, but who are still certainly in urgent need of hospital care. And only a limited, woefully insufficient number of beds available to them in other hospitals.

During the long years of the war we gave up our plans for the building of this dream hospital...**Hope Institute.**

But now we are more than ever determined to see it rise in stone and steel. A model hospital, the first of its kind ... cheerful and comfortable in every way ... with more the atmosphere of an apartment hotel than of a cold institution. Where the patients, depending upon their condition, can enjoy the warm hospitality of lounge and dining room, or retire to the merciful seclusion of a private room.

What do we need to build this hospital now? **You.** Every dollar or penny you can scrape together for it. Whether or not you know this tragedy from bitter personal experience ... the tragedy of whole families, endlessly frustrated in their determination to care for a doomed member ... give as generously as you can. Please fill out the coupon below and mail with your contribution. **It will** make this hospital more than a dream.

NCF

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INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

HENRY B. SELLWOOD, *Editor*

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MONTHLY CHAT

V-J DAY is now almost 14 months behind us. One would think that in the intervening period the motion picture industry would have been the beneficiary, in the form of greatly improved equipments and techniques in both production and exhibition, of the accelerated pace of research and development during wartime. The studio fellows are at least beginning to raise their sights to scan the distant technological horizons; but the exhibition forces are strangely, inexplicably somnolent.

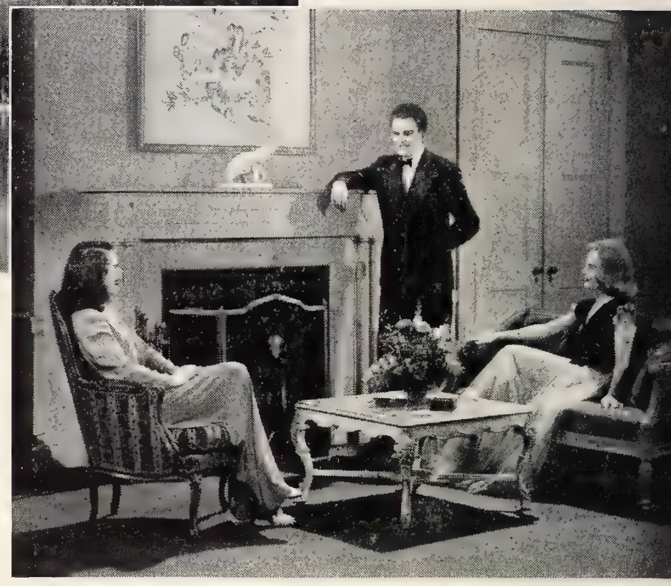
There are a few vague stirrings on the reproduction end: from England comes a report of intensive work on a non-intermittent optical projector; here in America the optical manufacturers have bestirred themselves sufficiently to achieve large-scale production of *f*/2 projection lenses and mirrors; another group is tinkering with the possibility of projecting, via a novel lens arrangement, color pictures from black-and-white prints; the carbon folks are straining after a super-super high-intensity carbon arc; Mr. Technicolor, feeling the hot breath of serious competition on his neck, is constantly improving his product and may come up with a very good bipack or even monopack system, and projector manufacturers are considering switching from a ¼ h.p. to a 1/3 h.p. motor.

Also in the offing, but nowhere near production status, is a new projector utilizing a 5-to-1 movement, which assertedly will enable the use of an a.c. arc without flicker. The 64° shutter on this baby will turn at 1800 r.p.m., instead of the conventional 1440.

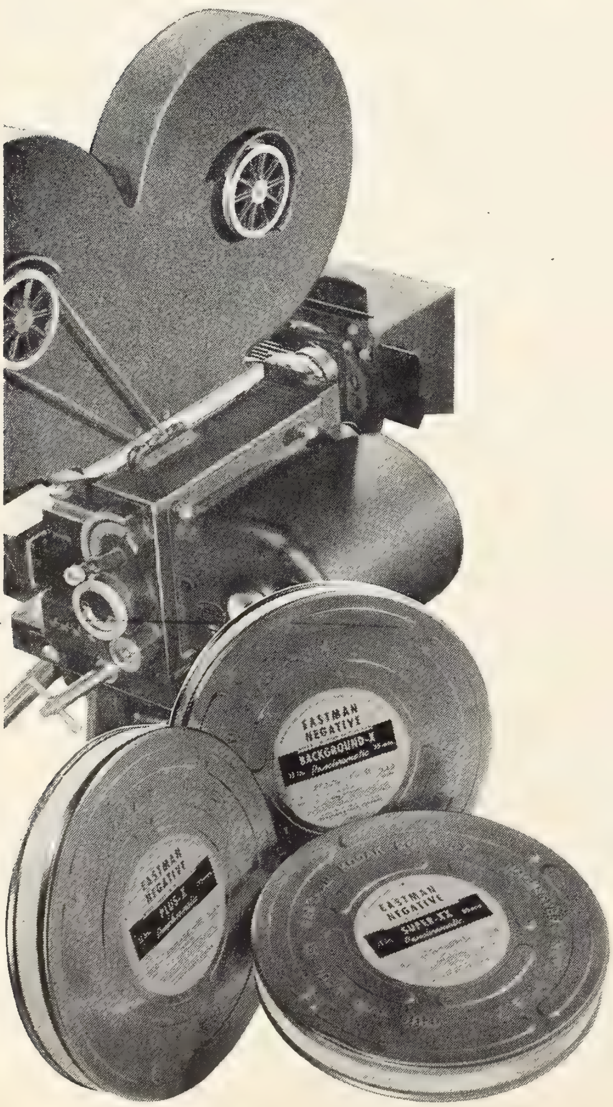
Excepting the last-named, all these items would accrue in the normal course of events and are largely dictated by necessity rather than any serious snooping in an effort to stir the brackish water of the film technological swamp.

Apart from the advances scored by the 16-mm crowd, a field so intensely competitive that those who tarry along the way are trifling with possible extinction, the only recent "hooray" development in projection is the unveiling by Forest Manufacturing Corp. of a means for electronically controlling the carbon feed in a lamphouse. This system may or may not redeem its early glowing promise; time alone will provide the answer. The important aspect of this development is that it represents an aggressively forward-looking attitude, the brand of snooping and courage which seeks to effect improvement by utilizing the fruits of modern technical advances, in this case a contribution of the electronic art. Such initiative is the mortal enemy of static thought.

The motion picture industry, and particularly the reproduction branch, is sorely in need of a greater measure of such initiative. "Progress is the activity of today and the assurance of tomorrow."



A Team for Production Work



WITH their fine grain, their similar rates of development, and their speed relationship that permits apertures of the same order for both exteriors and interiors, these two films form an ideal team for production work . . .

. . . ***Eastman Plus-X*** **. . . for general studio use.**

. . . ***Eastman Background-X*** **. . . for exterior use, under good lighting conditions.**

And when little light is available . . . when there's a need for increased depth of field without undue increase in illumination . . . ***Super-XX,*** another member of the Eastman family of films, gives this team added versatility and usefulness.

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Electron Flow vs Current Flow

By N. H. RANDALL

THE substance of each of the accompanying introductory statements was taken from as many text and reference books on radio theory. To the technically-trained they are understood and accepted from the viewpoint adopted by the author of the book. But to the less well informed on the principles of electricity and radio, and studying from the numerous references at hand, this apparent contradiction is often confusing.

Of course, there is always an explanation added stating that the mix-up is due to the fact that the direction of current was assumed to be from positive to negative before the action of electrons was known.

But does this statement clear up the matter to the average worker? Experience has shown that in the majority of cases it does not, and the question that almost invariably comes back is: If the electron flow is the same as the current flow, and electrons flow from *negative to positive*, how can the current flow from *positive to negative?*

The following analogy and explanation has proven in class work to almost always settle the question in the student's mind, and it is given here for precisely the same reason.

Direction of Current Flow

When the assumption that current flowed from positive to negative was first made, electricity was used primarily for such purposes as lighting, heating, ringing bells and running motors. The effects produced by electricity were what we were especially interested in. Since no means were at hand to definitely prove which way the electricity was flowing, it was assumed to be from positive to negative, and this flow was called an *electric current*.

This direction was probably decided upon because the prevailing theory at that time likened the electric current flowing in the wire to the flow of water through a pipe. And since water flows from a high level to a low level, and we generally assume *positive* to be *high* compared with *negative*, the assumption for the direction of the current was the most logical one to make.

When electrons were discovered, however, it was soon proved that they were the only things actually traveling in the conductor, and that they did not move from positive to negative but, rather, from negative to positive. But this discovery did not change the effects produced by the electricity as it flowed through the various circuits. Lights still burned as before, heaters still got hot, bells continued to ring, and motors continued to rotate without any difference whatever in their action.

Apparently, then, from a practical standpoint the knowledge of electron flow made no difference. But it did help from a theoretical point of view because it enabled us to more accurately predict how certain circuits would act.

Reconciling Theory and Fact

During the time that the fluid analogy was in use many rules and formulae were evolved to fix, for example, the relative direction of magnetic flux and the direction of the current causing it; or the direction of rotation of a motor when the direction of the currents through the armature and field circuits is known. All of these rules were based on the assumption that current flowed from positive to negative, and by the time the electron flow was found these rules had become so thoroughly fixed in electrical science that it was not practical to change them.

How, then, shall we retain these rules

DO THESE STATEMENTS CONFUSE YOU?

"Electron flow and current flow are the same, therefore current flows from negative to positive." * "The direction of current and the direction of electrons are opposite." * "The movement of electrons through the circuit is current flow. The direction of the electron flow is from negative to positive . . . The direction of current from a d. c. generator is from the positive brush through the external circuit to the negative brush . . . When the direction of current is known, the direction of the resulting flux may be determined by the right-hand rule." * "Although we speak of the current as flowing from positive to negative of the circuit, the electrons (which really are the current) flow from negative to positive."

and at the same time state that electron flow is opposite to the direction of current? Simply by continuing to assume that current flows from positive to negative, of course. So far, so good. But now comes the statement that the electron flow and the current flow *are one and the same thing, but opposite in direction to each other!*

To help us to visualize what is going on in the circuit let us consider this illustration. When it is said that a current flows along a wire from positive to negative, what is really happening is that the electrons are moving from atom to atom of the wire in a direction from *negative to positive*. They move in this direction because the electrons are themselves a *negative charge* and therefore the *positive charge* toward which they move *attracts* them; while the negative charge from which they move *repels* them.

Now, as they jump from atom to atom the electrons leave a *positive* charge on the atoms they just left; while the *positive* charges on the atoms to which they have just jumped have been neutralized by their own *negative* charges. In other words, the position of the positive charge in the circuit moves from in *front* of the electron to *behind* it as the electron moves along, and the change in the position of the positive charge is caused by the motion of the electron.

Now, a positive charge on an atom is caused not by adding anything to it but by taking an electron away from it. Therefore, nothing has moved in the direction of the positive charge except a *condition*, which condition is caused by the movement of the electron in the opposite direction.

To further illustrate this point consider the following analogy, which may appear to be rather silly but which nevertheless usually gets the idea across: Suppose we have a row of rocks with a frog sitting on each. If the frog on rock No. 1 jumps to the bank, his rock becomes vacant. Frog No. 2 then jumps to rock No. 1, and as he does so the *vacant condition* moves from rock No. 1 to rock No. 2. This is in the *opposite* direction to that taken by the frog.

If No. 3 frog now jumps to rock No. 2, the vacant condition moves in the opposite direction to rock No. 3. In the whole picture *what* has moved? Nothing, actually, except the frogs. But due to the motion of the frogs the *vacant condition* moved in the *opposite* direction. Yet the vacant condition is nothing but the lack of a frog on a rock.

Lack of Electrons Governs

Now to tie this up with the electrons and the atoms. Let the frogs represent the electrons moving from negative to positive, and let the vacant condition of the rocks represent the positive charge on the atom moving from positive to negative, or opposite in direction to the electrons. But the positive charge is nothing but a *lack of electrons on the atom.*

If we must have something to pin our imagination to in order to understand electron flow and current flow, think of the motion of the electrons as the *electron flow*, and the motion of the positive charge from atom to atom as the *current flow*. That is, as a matter of definition, let *current flow* mean that motion of the positive charge around the circuit, and *electron flow* mean the motion of the electron around the circuit.

Current flowing from positive to negative is measured in amperes, which is just another way of saying that it is measured in coulombs-per-second. The coulomb is the unit of electrical quality. It requires about 6,290 trillion electrons to equal one coulomb, so if that many electrons passed a given point in the circuit in one second of time it would be quivalent to one coulomb-per-second passing that point, or, as we usually say, the current is 1 ampere.

Since the more electrons there are passing the point per second the more amperes there are flowing, it will readily be seen that the so-called current flowing from positive to negative depends entirely on the flow of electrons from negative to positive, both as regards the *direction* of flow and the *value of the current in amperes.*

Video and Motion Pictures†

By RICHARD HUBBELL

Numerous refinements and improvements in the television art merely serve to emphasize the many similarities between video and motion picture production and exhibition. Essentially a producer, the writer of the appended qualitative article is a pioneer tele worker whose comprehensive knowledge of this new art has been widely recognized and acclaimed.

THEATRE people may think of television in terms of the theatre, and radio people in terms of old-fashioned, blind radio, but motion picture people and the general public are likely to think of it in terms of motion pictures. It is a natural reaction. Both are "moving pictures"; both use cameras, microphones, lights, and studios which look superficially alike. Motion pictures were made technically ready for commercial and artistic development nearly a half century ahead of television. The commercial birth of the motion picture industry is usually pegged around 1894, but pictures of that era remained pretty much on the primitive side. Technically and artistically, motion pictures did not reach maturity until the third decade of this century.

Television was under scientific development during most of these years, but it was not technically ready to make its debut until the last part of the 1930's. A few tentative bows were made at that time—notably by the British Broadcasting Corp. The American excursions into television programming were for the most part on a limited, amateurish basis. There was little serious effort, particularly when viewed in terms of the accomplishments of BBC television from 1937 to 1939—a time when the American television companies were bickering as to whether or not television was ready.

Video Matches 1930 Films

Almost all experimental program development was ended by the war, so that for practical purposes the beginning of serious *commercial* development of television programming may be pegged around the middle of the 1940's. This will be roughly 3000 years after the birth of the theatre, 50 years after the commercial start of silent pictures and 25 years after its artistic flowering, 20 years after the commercial sprouting of radio, and 15 or 16 years after the commercial and artistic beginnings (on a large scale) of sound pictures. In terms of technical perfection, however, television is roughly about as far along as talking pictures were in 1930.

Both television and motion pictures are based on science: without the accomplishments of science neither could exist. Both are industries as well as arts, with motion pictures one of the largest of American industries, and television giving every indication that it will be even bigger within a decade. Like motion pictures, television depends for its success on the cooperative efforts of many artists, technicians, and businessmen. It is too vast in scope, too complex for an individual artist to create and produce an entire program by himself—all of which leads inevitably to a high degree of specialization, such as we find in motion pictures and in radio.

The danger in this is obvious, and the

(*Continued on page* 25)

† This chapter from "Television Programming and Production" is published by permission of the publisher. Murray Hill Books, Inc., New York. $3.

Elements of Projection Optics

IV. Another article in a series anent the fundamentals of projection optics

By DR. ANGELO MONTANI

Consulting Engineer, New York City

IN I. P. for July we discussed the luminosity of projection lenses, which topic leads naturally to consideration of the optical system which feeds the light into the lens. A modern reflector light system is always composed of a curved mirror which collects the light radiated backward and reflects it forward toward the condenser lens. There are several types of these systems in use which attempt to exploit the maximum of light from the source and employ differently shaped mirrors and condensers. Generally the surfaces of the mirror and lenses are not spherical.

The common scope of all the systems consists in producing a surface of the maximum and most evenly distributed luminosity (for a given source) said surface being located in the second principal plane of the projecting lens. This plane must be imagined perpendicular to the optical axis and passing through point P of the projecting system. (See point P in Fig. 3 in our article in I. P. for July.)

It is evident, although very often overlooked, that the projecting lens cannot transmit more light than that concentrated by the mirror-condenser system. Disregarding the absorption and reflection losses, if a lens transmits all the light it is receiving, then a lens of larger aperture will not increase the brilliance of the image upon the screen since it will not get any additional light from the source. A lens of smaller aperture, on the other hand, will reduce the intensity of the projected light since it will be unable to utilize the entire amount of light produced by the illuminating system.

Practically the optimum condition of utilization of available light is achieved when a light spot of the diameter of the lens of even brilliancy can be collected on a white surface in the position where the back element of the projection lens is generally located. Due to the high concentration of heat which would carbonize any paper or cardboard, some other non-combustible and non-glossy surface must be employed. The observation should be made, of course, through a deep neutral glass. In this way it is possible to determine the correct distances yielding even illumination and correct size of the spot. The smaller the spot of light, the more brilliant it will be; on the other hand, the spot must fill the entire surface of the back element of the lens.

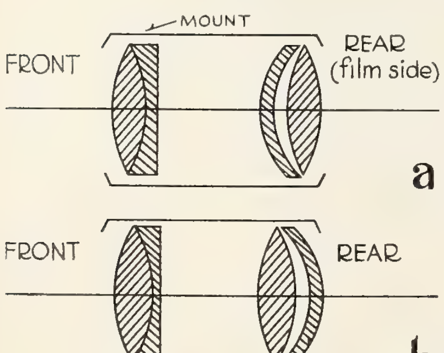


FIGURE 1

Uneven distribution of the light in the spot may cause objectionable "hot spots." When this is the case, some scattered zones of the screen appear to receive more light than the neighboring zones, particularly at the sides. Hot spots can be readily detected by throwing the beam on the screen without any film in the gate and positioning an even deep neutral screen in front of the projecting lens. Due to the responsitivity of the eye to the illumination stimulus, unevenness on the screen is better detected when the light is rather dim.

'Flatness' of the Field

Elementary optical laws teach us that it is impossible to obtain even illumination of the screen with relatively simple means. The center of the field will always be more brilliant than the sides. Practically, however, it is possible to make the eye ignore such a difference for small field extensions because, luckily, the eye does not record the *absolute ratios* of illumination but only their logarythmic values. The center of the screen receives rays perpendicular or almost perpendicular to it. The portions around the edges, however, receive oblique rays which for an equal angle of spray fall on a larger area and thus occasion diminishing brilliancy.

In projection in general the angle of the field is kept rather limited and the difference in luminosity between the central zone and the sides is almost below the intensity discrimination of even a trained eye.

The most popular of the projection lenses in use today is the direct derivation of the very first objective which was designed for photographic work. Since this type of projection lens is most widely used, few descriptive words are necessary about it. A schematic of the lens is presented in Fig. 1a. This lens is corrected for color, spherical

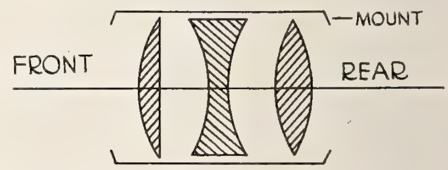


FIGURE 2

aberration and astigmatism. The prototype of this lens was calculated in 1840 by a Viennese mathematician named Petzval, and at that time it was not color-corrected because the proper glass was not then available. Sometimes the second doublet is cemented (the elements having a different shape) and this is found on projectors which do not develop too much heat, such as the 8- and 16-mm types. Other manufacturers invert the position of the elements of the second doublet, positioning the convergent lens inside and the divergent lens outside, as in Fig. 1b (Dallmayer type).

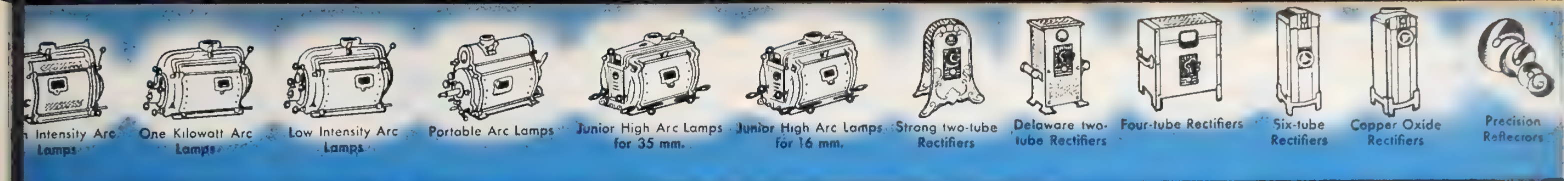
Lenses of the aforementioned general construction (Figs. 1a and 1b) can be easily manufactured in large apertures up to $f/1.9$ for moderate fields of from 12 to 14 degrees. Since the field is limited, the image projected is satisfactorily sharp and flat.

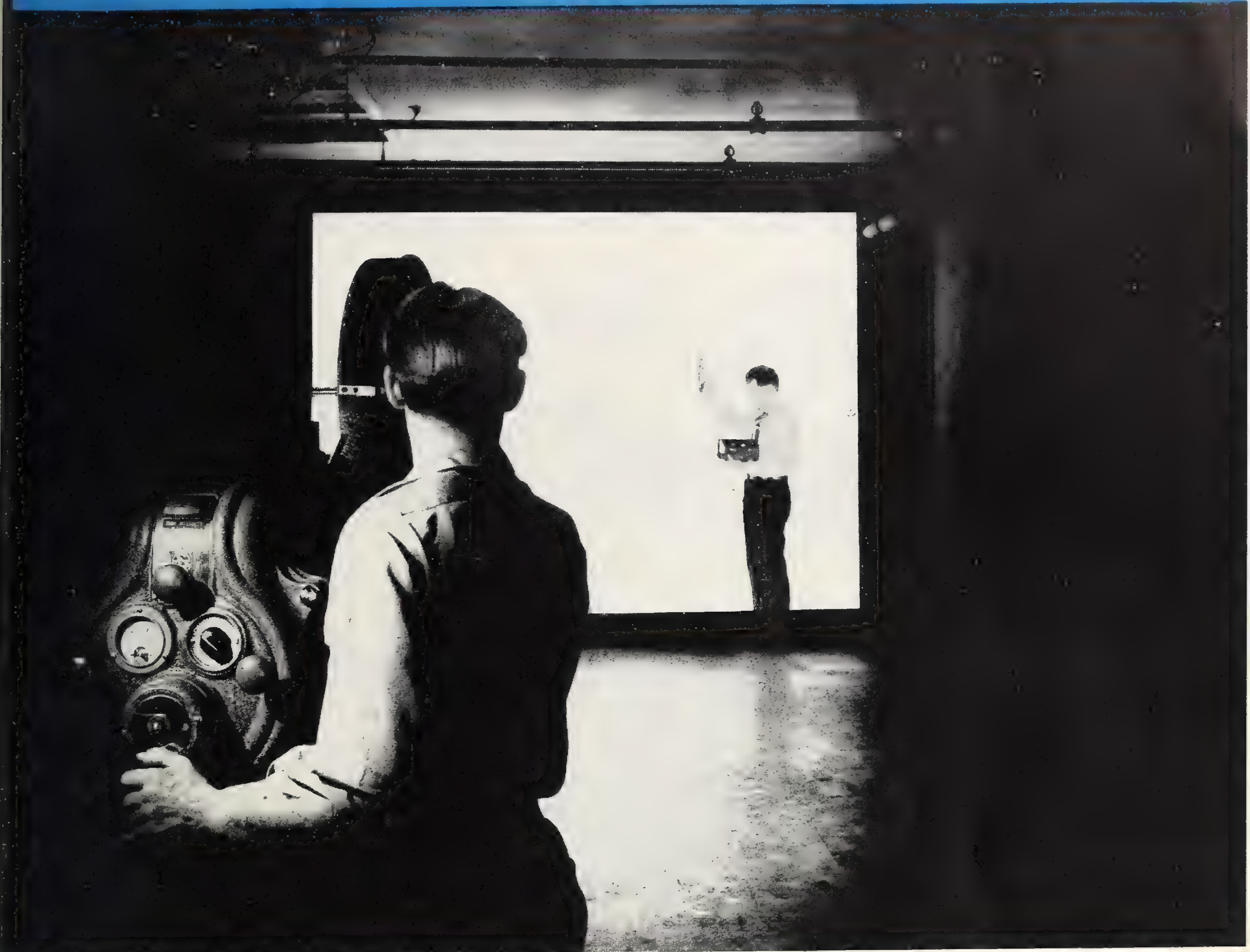
A second type of lens sometimes used in projection is schematically sketched in Fig. 2. Such a lens derives from the Cooke lens designed for photographic cameras in 1895 by H. Dennis Taylor. This lens possesses a satisfactory flat field which is much more extended than the one shown in Fig. 1. It is made with apertures up to $f/3$ and yields sharper images having increased contrast effect.[1]

Other types of lenses have such limited applications as to not warrant a description herein.

In general, motion picture projection lenses cover a narrow angle of the field since of necessity the screen must

[1] For a popular exposition of the various types of lenses refer to "The Evolution of the Photographic Objective," by A. Montani, American Annual of Photography for 1946, p. 149.





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Before the design of any Strong lamp is definitely adopted, performance screen checks are made in our own projection room under actual theatre conditions. Flatness of field, uniform light steadiness and distribution, screen brilliancy and freedom from color change are measured and recorded with sensitive graphic meters that plot the entire screen area, so that the performance of the lamp can later be carefully analyzed.

When a lamp passes all the tests, proves that it will stand up under the most gruelling usage, and meets the high standard of performance that is demanded of all Strong equipment it is then, and only then, ready for production and delivery to you. So, when you buy Strong projection lighting equipment you know you're getting the best product of its kind that money can buy.

Furthermore, Strong research does not stop with work on projection arcs, but includes rectifiers and reflectors which similarly call for painstaking care in development so that their functions may be properly coordinated with those of the lamp.

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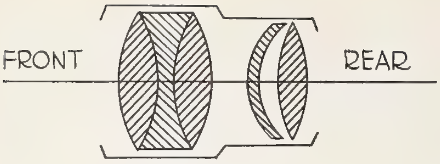


FIGURE 3

be located the length of the auditorium removed from the projector. Cases might arise where a larger than conventional angle is required—for instance, in the adaptation of old theatres into motion picture houses or in traveling projection outfits. The only wide-field projection lens that we know of is represented in Fig. 3. It does not have a trade name but it was developed by the W-M Instrument Corp. of New York. The lens employs new glasses and the field is satisfactorily flat up to 38 degrees at $f/3$. The uniformity of illumination of the field is remarkably good.

Wide-Angle Projection Lenses

In travelling projection outfits where they have to exhibit in improvised movie auditoriums or in the open air at night, the matter of filling the screen is a problem at every performance. In such cases the distance between projector and screen is constantly changing since it depends upon the dimensions of the hall or the number of people in the audience. To cope with the situation the projectionist must have at his disposal interchangeable lenses with different focal lengths.

The ideal solution in this case would be to have available a projection lens with a continuous variable focal length, that which is known as a "zoom lens." Zoom lenses are generally very complicated. They possess several elements and are extremely expensive. This last drawback of price almost precludes their use for projection. It is nevertheless possible to obtain a satisfactory zoom projection lens with only six elements which doubles the focal length and has a minimum luminosity of $f/4$. (The writer calculated and made a sample thereof.)

Figure 4 illustrates the performance of such a lens which fills the entire screen over a wide latitude of the projector-screen distance. The lens is focused in the following manner: first the front element (cemented doublet) is displaced back and forth until a blurred image of the correct size fills the screen; second, the rear element (cemented and air-spaced doublet) is also displaced until the image appears sharp.

Some Defects of Lenses

We have considered in previous installments the optical defects or aberrations of lenses. We shall now consider several defects which are found occasionally in lenses of even the best manufacturers. A defect that sometimes occurs in lenses produced by small and unreliable firms consists of streaks or veins in the glass of one or more of the elements. Such elements should never have found their way into a complete objective but should have been promptly rejected upon inspection, because the lens will give an impaired image. Objectionable streaks may be revealed by observing the appearance of a white square paper when located in back of the lens: no contortion of the lines must be apparent.

A more accurate inspection is accomplished by positioning the lens between two Polaroid glasses and rotating them until the light is completely extinguished. Any streak will be revealed as a luminous vein. This procedure also shows up any strain in the elements which may be due to imperfect annealing or an imperfect or bent mount. A mount may have been bent by being dropped or hit. When strains are present the entire area through the lens does not become black simultaneously, and some kind of whitish clouds will still be observed when the light is extinguished.

Hairlines and Scratches

An effect, which in most cases is not a defect at all although often confusing to people in the art, is "bubbles" in the glass. A few small bubbles up to 1/32nd of an inch are definitely not objectionable in a common projection lens. Bubbles are produced by trapped gases in the melting process, and in certain types of optical glass they cannot be completely eliminated without changing the characteristics of the glass. Bubbles can be detected just by looking at the lens in normal light; small bubbles may appear as black pinpoints.

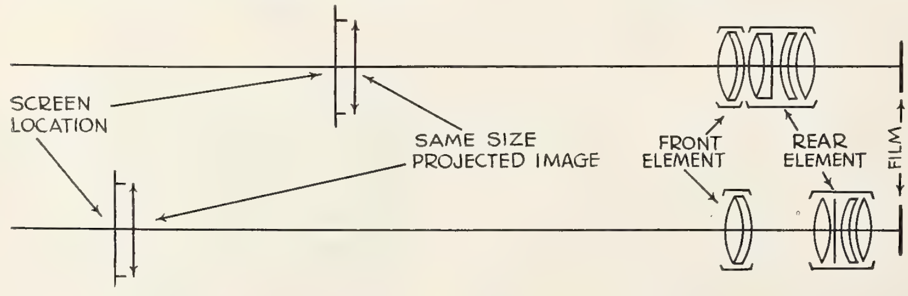
Hairlines and thin scratches which, when looked at against the light in every direction do not show crystalline edges scattering the light, are not objectionable. Such defects, however, greatly reduce the commercial value of the lens.

Never try to remove a hairline by hand-polishing the surface of the lens, because the true curvature of the surface would be irreparably damaged. A hairline on a lens surface is there permanently and nothing can be done about it. Anybody who claims that he can by a "special method" remove hairlines and scratches from a lens is either misinformed or deliberately misleading. The writer stresses this point because he knew of a self-styled "optical company," not now active, that did quite an extensive "polishing" business.

Misalignment of the elements also causes inferior projected images. This can be detected by rotating the lens during projection and observing if the edges of the image displace with reference to the screen. Misalignment is generally caused by elements edged out of center, defective assembly into the mount, or damaging of the mount during use.

There are also several other defects of a lens which are impossible to detect without adequate equipment. The only practical way to avoid them is the exclusive use of lenses manufactured by firms of established reputation.

FIGURE 4



New German Processes For Non-Reflecting Lens Coatings

Two German processes for depositing hard non-reflecting coatings on optical lenses are described in a report now on sale by the OTS of the Department of Commerce. One of the processes involves evaporation of the coating material in a vacuum, and the other, use of a hydrogen flame (OTS-425).

Zeiss believes that non-reflecting surfaces for optical lenses and prisms are best made by evaporating a thin layer of coating material onto the glass in a vacuum chamber. They claim that a hard coating can be evaporated directly onto optical glass if the chamber is kept extremely dry. In American practice, non-reflecting coatings applied by the vacuum chamber method are hardened by baking the finished lens. No special effort has been made in the U. S. to keep the vacuum chamber dry.

Zeiss uses a cryolite coating for protected inner glass surfaces in optical instruments, and magnesium fluoride, a harder but less efficient coating, for exposed surfaces. The precise amount of material needed for the desired thickness is placed in the vacuum chamber, together with the lens or prism and a shallow pan of phosphorus pentoxide to absorb moisture. Air is exhausted from the chamber. The coating material then is heated to incandescence and evaporated onto the glass.

A hydrogen flame is used to deposit non-reflecting coatings on optical glass in a process developed by Schott & Genossen. The lens is revolved directly in front of a burner from which shoots the flame bearing the coating material. Coatings made in this manner were found to be quite hard. Tests indicated that they reduced reflection to 0.1 to 0.3 per cent.

The Forest Electronic Arc Lamp

By J. K. ELDERKIN

Forest Manufacturing Corporation

Considerations of patent security render it inopportune to publish herein diagrams of the electronic circuit of this new development, as was announced in our last issue. Publication of this schematic material will be effected as soon as possible following publication of this second and concluding article of this series.

THE Forest electronic projection arc lamp* is actuated and driven by solenoids instead of the usual motor. In order for the solenoids to impart rotary motion to the worm screw which feeds the carbons it is necessary to feed the solenoids with impulses of electrical energy.

As is well known, a solenoid works on the principle that when it is energized the core will move in one direction until the current is cut off, following which the plunger will return to its normal position. In order to obtain intermittent motion, therefore, it is necessary to energize the solenoid and then de-energize it so that the plunger will move up and down at a speed dependent upon the number of impulses per minute fed to the solenoid coil.

A device for producing these impulses has been developed and is called an "electronic timer." The circuit used in this timer is new and patents covering it are pending.

Electronic Timer Data

The Forest electronic timer employs a small Thyratron tube in circuit with condensers and resistors in such manner that the time-cycle during which current flows through the device can be regulated at will by simply increasing or decreasing the amount of resistance in the control circuit. By merely turning the knob of the variable resistor clockwise or counter-clockwise, the number of impulses from the timer will be increased or decreased so that the speed of the lamp feed mechanism can be perfectly and accurately controlled to feed the carbon forward at the exact rate of its consumption.

* Patent pending.

The dial of the variable control is graduated in arc amperage and type of carbon so that it can be readily set to the proper point for the arc current being utilized in that lamp. A slight further adjustment of this control knob will then maintain the feed at its proper speed and no further change is necessary unless the arc current or the size of carbons is changed.

The principle involved in the electronic timer is as follows:

1. Plate current flows through a resistor and through the load. The potential difference across this resistor is fed to a condenser through a second resistor.

2. The potential across the condenser builds up gradually and is fed to a second condenser through a third resistor.

3. The potential across the second condenser builds up gradually and reaches the critical grid voltage of the tube and causes the plate current through the load to cease flowing.

4. The potential across the condensers is gradually discharged through the resistors and thus the control grid potential is reduced to the point where the plate current will again flow hrough the load, starting a new cycle.

5. As the frequency of operation is dependent upon the speed at which the potential across the condenser changes, the timing may be precisely controlled by proper selection and variation of resistors.

Wide Control Range Possible

The electronic timer used with this projection lamp is so designed that by use of proper resistors and capacity a wide range of adjustment is possible. The lower setting gives a timing too low for feeding any of the present carbon trims and its upper limit gives a timing too fast for feeding any of the present carbons. The intermittent steps between the two extremes are fine enough so that exact timing for any carbon consumption can be obtained.

The Forest electronic projection lamp employs *two* electronic timers, one for the positive feed and one for the negative feed, and they are built into the lamp in such manner that they are removable as easily as a tube is removed from its socket.

The life of the Thyratron tube and the associated parts of the timer is extremely long, and since the lamp itself has no fast-moving parts, the combination makes a true-feeding, trouble-free and extremely simple projection lamp.

SMPE 60th Convention Has Record Papers Program

SIXTY-TWO technical papers, presenting a most comprehensive assembly of wartime and postwar motion picture engineering developments, were scheduled for the 60th semi-annual convention of the Society of Motion Picture Engineers at the Hollywood-Roosevelt Hotel in Hollywood, Oct. 21-25. Practically every phase of motion picture technology was slated to be covered, and the unprecedented number of papers to be delivered occasioned duplicate sessions on non-overlapping subjects.

The sessions were opened with the traditional get-together luncheon at which Byron Price, association of producers executive, was scheduled as the principal speaker. All evening sessions were slated for motion picture studios, including Paramount, Republic and Disney lots.

Aspects of television to be discussed include "The Time Element in Television Program Operation," by Harry Lubcke, of Don Lee Studio; "Showmanship Side of Theatre Television," by Ralph Austrian, of RKO Television; and "Film Projectors for Television," by Ralph V. Little, Jr., of RCA.

Also up for consideration is the S.M.P.E. program of close cooperation in extending the teaching of film subjects in educational institutions throughout the country. Motion picture terminology in the form of a greatly expanded glossary will be reported on as a preliminary to its submission as an official American standard.

Among the papers scheduled abstracts of which are of particular interest to projectionists are the following:

FILM REEL LOCK AND IDENTIFICATION BAND

By *Gare Schwartz*
20th Century-Fox Studios

It has always been a problem to hold the film against unwinding either temporarily or permanently. Various expedients such as metal clips which scar the film, rubber bands which mark the film, small clamps, and the like, have been used for this purpose.

Release prints are bound with a paper band which is wrapped around the reel and held in place by a string. As the band usually contains the data relative to the film, and as they must be removed each time the film is used or examined, and since each band fits only its particular reel, it must be replaced upon the exact reel or confusion results.

The proposed Film Lock is an integral part of the film so there is no possibility of misapplying the data relative to the films as the lock becomes a part of its respective reel. The Film Lock amounts to forming a tongue on the end of the film with a groove or series of grooves formed in the body of the film

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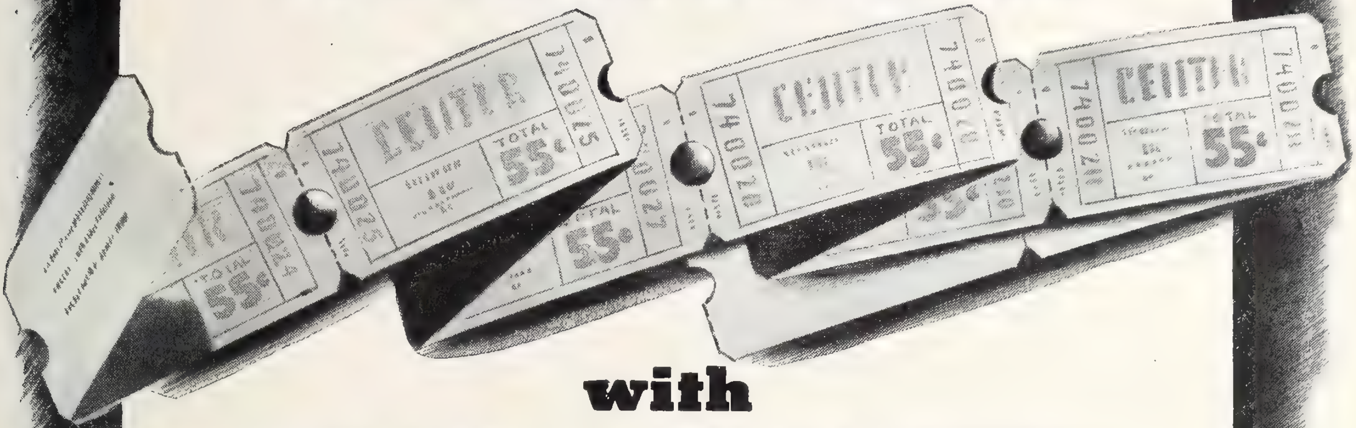

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adapted to receive the tongue, so that the outer strand of film may be locked on itself by inserting the tongue through out of the grooves. The Film Lock may carry indicia identifying the film.

A simple punch quickly accomplishes the forming of the tongue and groove in a single operation, and in practice the Film Lock could be made and kept in stock and spliced onto their respective reels or made an integral part of the film itself.

COAXIAL AND SEPARATE 2-WAY SPEAKER SYSTEMS

By *Howard T. Souther*
Stephens Manufacturing Co.

Since the first prototype of the coaxial 2-way speaker was put into operation at the Lockheed Air Terminal, in 1940, improvements in design and manufacturing processes have been transpiring at a constantly accelerating rate. This has been due principally to the advent of FM radio, Vinylite record pressings and the educating of the public to high-fidelity through theatre sound employing 2-way systems.

Diverse Considerations Necessary

The impetus given to high-fidelity transducer design because of the commercial possibilities involved has called for certain considerations in product engineering, dedicated toward reduction of cost and better performance. This paper deals with factors involving choice of magnet structures, number of dispersing cells, design of horn flare, crossover frequencies and networks, ease of servicing, general production and use problems.

A NEW BLOOPING DEVICE

By *George Lewin*
U. S. Army Signal Corps

This paper describes a method of automatically silencing the splices on work prints used for re-recording. Holes are punched in the picture area of the sound track by means of a convenient foot-operated punch, at a fixed distance from each splice. These holes then serve to operate a switch in the re-recording head so that the sound output is momentarily cut off while the splice is passing the scanning beam.

MAGNETIC SOUND FOR MOTION PICTURES

By *Marvin Camras*
Armour Research Foundation

A magnetic sound track on motion picture film is convenient and economical. The final recording can be monitored while it is being made and requires no processing. All or part of the sound track can be erased, and a new record put on or edited in the usual manner. Apparatus for making high quality record is described, including the soundhead, constant-speed-drive mechanism, amplifier equipment, and the magnetic track. Overall performance, frequency response, dynamic range and distortion are given.

MAGNETIC SOUND RECORDING ON COATED PAPER TAPE

By *H. A. Howell*
Indian Steel Products Co.

This paper discusses the application of coated paper tape as a magnetic sound recording medium. The special features of this interesting new development which may render it desirable for many commercial uses are pointed out. Current trends in recorder design are discussed. A brief summary of tape recorder performance is given, including dynamic range, frequency response and distortion characteristics. Some special features of the new recording medium relative to its possible use in the motion picture industry are pointed out.

A MAGNETIC SOUND RECORDER OF ADVANCED DESIGN

By *R. J. Tinkham* and *J. S. Boyers*
Magnecord, Inc., Chicago, Ill.

Recent developments in magnetic recording have led to practical use of this art as a high fidelity recording system. The particular apparatus described is the result of a need for wire recording equipment of professional calibre. It is characterized by good frequency response, low distortion, freedom from "wow" and flutter and by a lock-in synchronous drive. The electrical and electro-magnetic portions are the results of experience gained by research during the war. The mechanical portions have many parallels in motion picture equipment design. This apparatus is suitable for many motion picture recording applications.

RECENT DEVELOPMENTS IN MAGNETIC RECORDING

By *S. J. Begun*
Brush Development Company

New magnetic recording media have been developed during recent years which will widen substantially the field of application for magnetic recording equipment. Probably most outstanding among the new recording media is the non-ferrous wire or tape, plated with a thin layer of nickel-cobalt alloy, and the paper discs and tapes coated with a dispersion of magnetic powder.

It might be of particular interest to the

(*Continued on page* 28)

Picture Brightness Terminology

NO LITTLE confusion anent the proper terms for describing picture brightness is evident among television engineers, a strange situation inasmuch as the motion picture industry has long since standardized such terms. Some tele engineers define their picture results in "foot-candles"; others use "foot-lamberts." The term "lambert" also appears in the literature of the art, adding to the confusion.

An outstanding illumination authority, Dr. Matthew Luckiesh, director Lighting Research Laboratory of General Electric at Nela Park, Cleveland, Ohio, and author of *Light, Vision and Seeing*,* recommends that "foot-lamberts" be used to define picture brightness, and that the television industry always express its standards in this unit, already generally used by illuminating engineers to measure brightness.

"The foot-lambert is the accepted unit in our English system of light measurements," says Dr. Luckiesh. "This unit is very easily understood. For example, if we had a white diffusing surface that reflected 100% of the incident light, its brightness in foot-lamberts would equal numerically the illumination expressed in foot-candles. In other words, 10 foot-candles on such a surface would produce a brightness of 10 foot-lamberts.

Simple Brightness Test

"If the diffusing surface reflected only 50% of the incident light, a brightness of 5 foot-lamberts would result from an illumination of 10 foot-candles. In the development of television, I am sure that it will be best for all concerned if the brightness of television screens and of their surroundings be measured in foot-lamberts.

"Incidentally, if one has a foot-candle meter he can make a rough estimate of brightness by comparing the brightness of the television screen with that of a white blotting paper. One may assume that the latter reflects 80% of the incident light. Therefore, if one measures the foot-candles on the white blotting paper when it is about the same brightness as the television screen, the brightness in foot-lamberts will be 80% of the foot-candles on the blotting paper.

"Motion picture screens in the better theatres have a brightness of 10 to 15 foot-lamberts. The recommended movie value at the present time is 14 foot-lamberts. There is nothing final about this. Actually the recommendation is based upon what can be achieved under reasonable conditions."

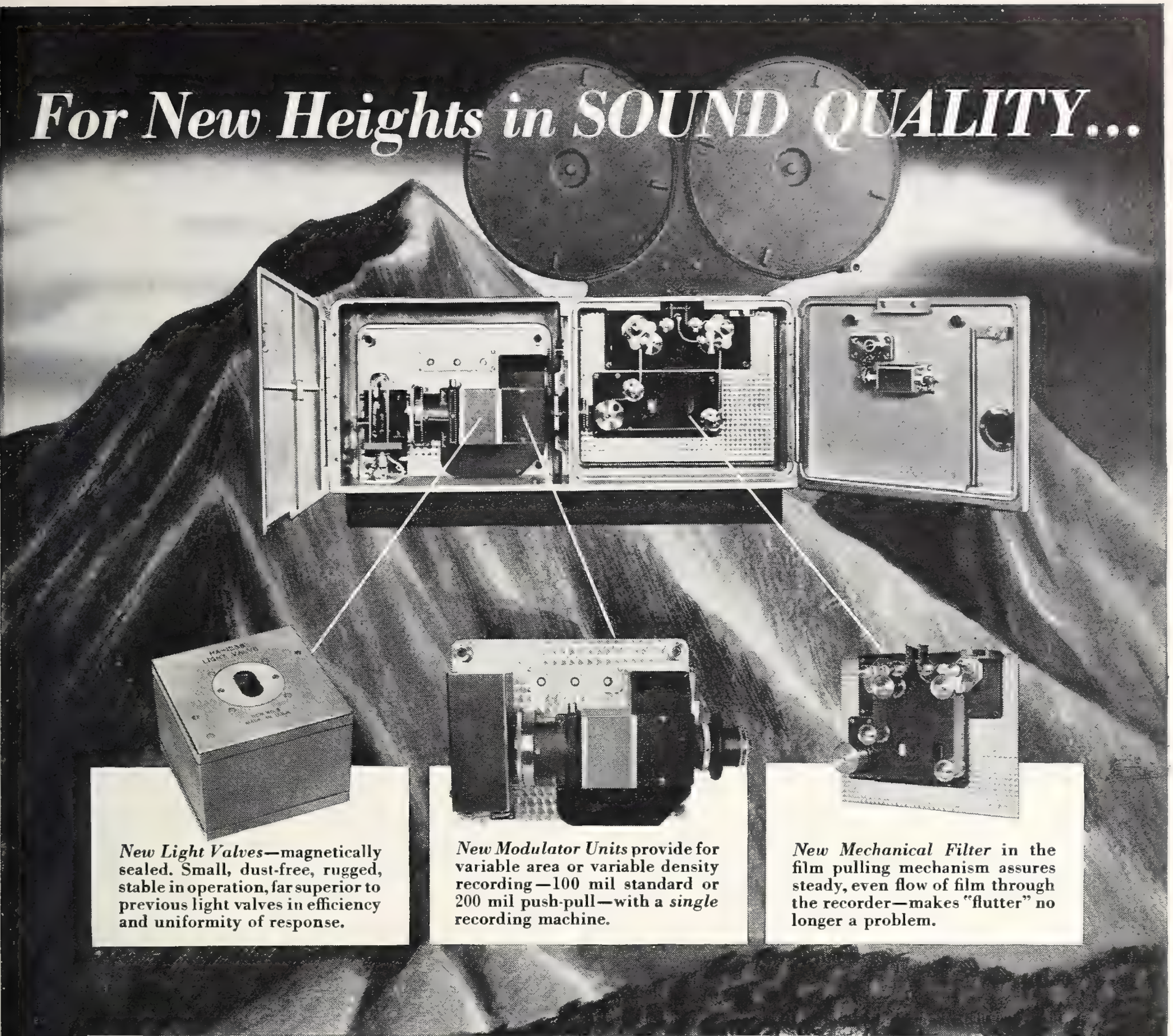
Advocates Supplementary Light

Incidentally, Dr. Luckiesh has tried for years to get movie exhibitors to have some light on the front wall surrounding the screen. This makes for more comfortable seeing, he insists—actually increasing the sensitivity of the visual sense. However, motion picture theatres still believe that the screen should be surrounded by darkness. Dr. Luckiesh's recommendation, of course, has a lesson for television users also.

For those interested, it may be added that Dr. Luckiesh's recent book, *Light, Vision and Seeing*, is a popularly-presented condensation of his extensive researches in seeing. In it the author deals with brightness from various viewpoints.

Chapter 6 provides the fundamentals in an easily understandable manner and includes some data on brightness measurements. Chapter 14 deals with "brightness engineering," which is a phrase the author has coined to emphasize that seeing is almost entirely a matter of brightness engineering. On page 220 and thereafter the author discusses the surroundings of the motion picture and the television screen, and from the condensed data apparently proves that screen surroundings should be bright and not dark.

* Van Nostrand, New York.



New Light Valves—magnetically sealed. Small, dust-free, rugged, stable in operation, far superior to previous light valves in efficiency and uniformity of response.

New Modulator Units provide for variable area or variable density recording—100 mil standard or 200 mil push-pull—with a *single* recording machine.

New Mechanical Filter in the film pulling mechanism assures steady, even flow of film through the recorder—makes "flutter" no longer a problem.

Western Electric

400 TYPE RECORDING SYSTEM

The "400" is the top number in Western Electric's new line of sound recording equipment. It's simple to operate, gives unequalled sound quality and is so flexible and adaptable that it handles with ease the most difficult recording assignments. It records 35 mm variable area or variable density tracks, either 100 mil standard or 200 mil push-pull.

In addition to the recording unit shown above, all other units in the system—mixer, limiting amplifier, noise reduction unit, regulated power supply and fully automatic recorder controls—are newly designed and "packaged" to enable studios to put finer-than-ever sound in their pictures of tomorrow.

Electrical Research Products Division
OF
Western Electric Company
INCORPORATED
233 BROADWAY, NEW YORK 7, N. Y.
Hollywood Office—6601 Romaine Street

Some Historic Firsts: The Orthophonic Phonograph

IN 1877 Thomas A. Edison cut his first phonograph records, thus providing a new form for musical expression, and laying the foundations for an entirely new industry. It was a brilliant and useful invention, but the small amount of power in the original sound waves seriously handicapped this new art.

At practical recording distance, the average power in ordinary speech sounds is much less than a millionth of a watt per square inch. With this extremely low intensity of power, a very large area had to be spanned by the mouth of a sound-gathering horn so that after transmission through the horn and a diaphragm and linkage of mechanical elements, it would be sufficient to force the stylus to cut the record.

Even when this was done, many portions of the speech syllables and many of the harmonics were of so little power that they were unable to record themselves at all. For even the modest results obtained, the musicians and singers had to be crowded close to the recording horn, and the weaker strings had to be reinforced by artificial means. The problems to be solved in reproducing were about as great and of the same general character as in recording.

During the forty years following Edison's invention, many ingenious methods were devised to reduce the restrictions caused by the very limited power available. During the latter part of this period, however, a new science was rapidly developing—that of the electrical transmission of sound frequencies.

The theory of electrical transmission over telephone lines, including those containing lumped inductances and capacitances, had been worked out, and important new instruments were being developed. Those of particular value to the phonograph were a condenser microphone to faithfully transform the sound to electrical waves, and a vacuum-tube amplifier to increase the very small output from the microphone to the power needed for cutting.

Electronic Aids Enlisted

The possibility of applying this new science and those new devices to sound recording and reproducing was recognized at Bell Laboratories at least as early as 1915. In a memorandum from H. D. Arnold to E. H. Colpitts dated June 7 of that year, Dr. Arnold pointed out that the new transmitters, receivers, and telephone repeaters should make it possible to cut records and reproduce from them with much better quality than had been obtainable with the methods used before.

Familiar with this new science and the instruments it had made possible, H. C. Harrison developed a recorder in which the armature, the cutting stylus, the connecting shaft sections, and a rubber transmission line were combined as elements of an electro-mechanical network. He was able to use electrical transmission theory as a basis for this recorder because he recognized that in mechanical transmission systems, masses are analogous to electrical inductances as elements for storing kinetic energy. Similarly, compliances are analogous to capacitances as elements for storing potential energy.

Mechanical resistance was provided by using a soft rubber rod in torsion. Such a rubber rod is a high-loss transmission line, and hence can be used as a mechanical resistance. At the armature, which is the coupling point between the electrical and mechanical transmission systems, the impedances of the two systems were matched.

With the completed recording system including a condenser microphone, an amplifier and the rubber-lined recorder, the orchestra and singers could be in their usual positions for a concert, instead of crowded around a horn as for the earlier recordings. On the finished records, all the important components of the music were present with satisfactory volume range and a frequency range of five to six thousand cycles instead of the former 3000.

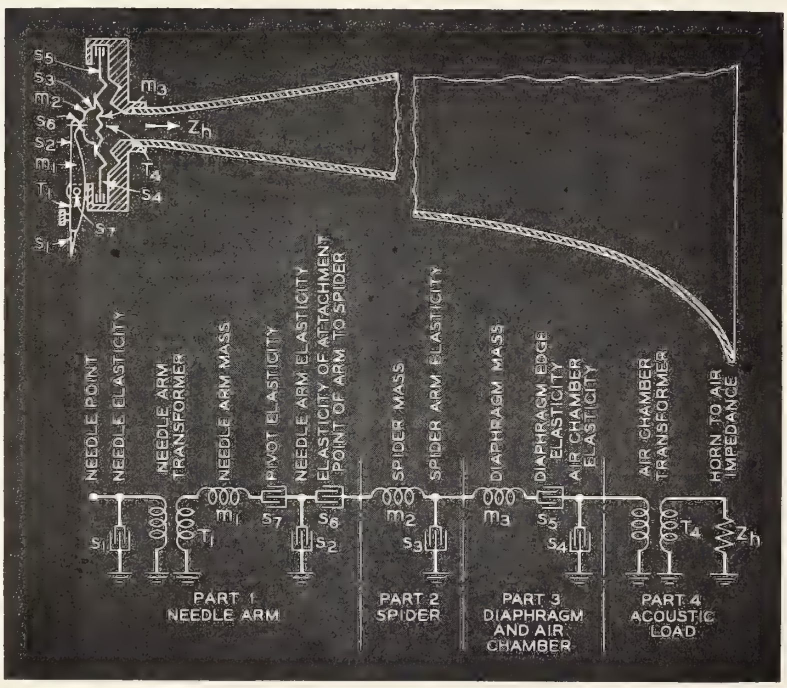
Greatly Extend Frenquency Range

With the problem of the recorder worked out, Mr. Harrison developed an acoustic phonograph. It was designed as a mechanical transmission system, beginning at the needle point driven by the undulation of the groove in the record. The compliances and masses were proportioned to transmit the full range of frequencies to the diaphragm, which as a mechanical-acoustic transformer transmitted the mechanical vibratory energy to the tapered acoustic transmission line of the horn.

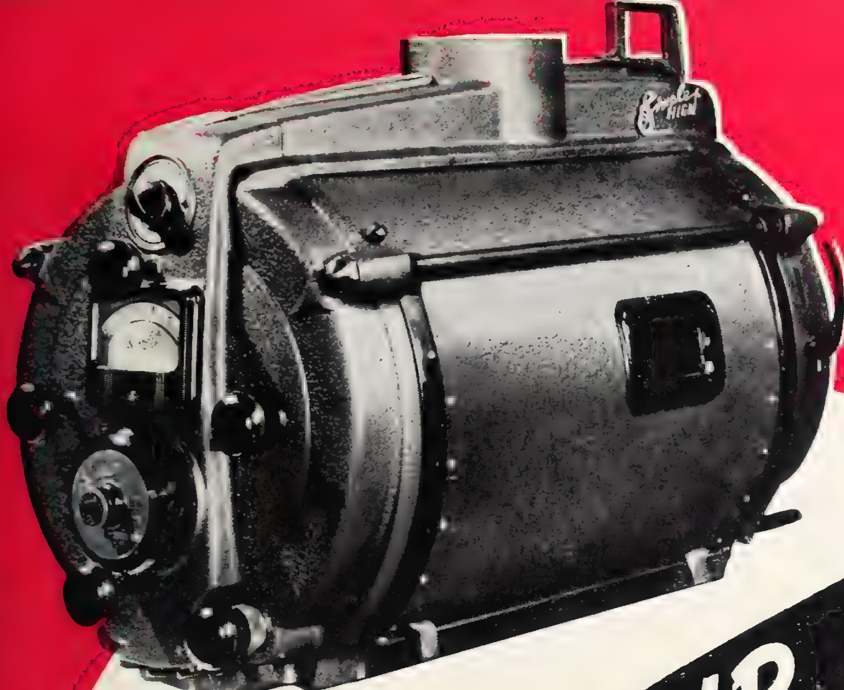
The horn was curved logarithmically and was given such a rate of taper that the full range of frequencies was transmitted, and such a length that the mouth was large enough to radiate the low frequencies. To secure a compact unit incorporating the comparatively long horn that such a design made necessary, the horn was folded back on itself so as to fit in a moderate space.

With the new records and this new phonograph, reproductions were obtained which approached the original rendition in quality. The matched transmission-line phonograph was announced publicly under the name "Orthophonic" on October 6, 1925, at a dinner given at the Waldorf by the Victor Talking Machine Co., which had been licensed under the W.E. patents.

Since then, a number of improvements and modifications have been made, and electrical reproduction is widely used to make the electrical recordings an adjunct of the radio, but in these and in the further extensions of sound recording and reproduction to motion pictures, many of the same underlying principles have been responsible for the high-quality reproductions obtained.



Schematic showing electrical analogue for orthophonic mechanical reproducer.



IN THE SPOTLIGHT

By HARRY SHERMAN

THE readers of these columns are pretty well acquainted with our views on the subject of extra pay for Sunday and holiday work. As we pointed out time and time again practically every industry in the country—with the glaring exception of the theatrical industry—recognizes the fact that employees should be properly remunerated for working on those days. If an employer expects his employees to give up their holidays to advance his (the employer's) interests, adequate compensation should be made to the workers therefor. Theatre admission prices are boosted on Sundays and holidays at all theatres—neighborhood as well as the de luxe houses—bringing added revenue to the box office at no extra expense to the exhibitor. We believe that this has been a one-way proposition long enough, and judging from our correspondence with union officials throughout the country, much serious thought is being given the matter.

We were glad to learn, therefore, that a step in this direction was taken by I. A. representative Roy Brewer and Cappy Du Val, business agent for Hollywood Local 44, in their recent negotiations with the studios. The new contracts cover a 40-hour week, 8 hours per day for 5 days, with TIME-AND-ONE-HALF for Saturdays. That's what we call being on the beam!

● Tom O'Brien, member of the British Parliament and general secretary of the National Association of Theatrical and Kine Employees Union in England (equivalent to our I. A.), is now in this country getting some first-hand information on how our unions function. He attended the A. F. of L. Convention in Chicago, where he was the guest of honor at a dinner given by Chicago Local 110. While in New York, O'Brien was tendered a luncheon by I. A. president Walsh, which was attended by representatives from many local unions in and around this city.

Representing the General Office were president Walsh, Wm. P. Raoul, general sec.-treas.; Thos. J. Shea, ass't inter. pres.; James J. Brennan, 4th vice-pres.; and I. A. rep. Jos. Basson. Others present at the luncheon were Matthew Levy, attorney for the I. A.; William Collins, N. Y. representative for the A. F. of L.; Herman Gelber and Nat Doragoff, Local 306; Walter A. Lang, Local 644; William Nagengast, Local 640; Viola LaPreste, Local 702; Sal Scoppa, Local 52; Tom Murtha and Len Risley, Local 4; Solly Pernick, John Goodson, J. McDowell, and Joe Dwyer, Local 1; Morrie Seamon and James Murphy, Local 751; Arthur Martens and Dick Hayes, Local 650.

● A 27½% increase in salary for the projectionists is the basis of a new contract recently signed between New York City Local 306 and the Newsreel Theatres. These houses, of which there are quite a few in New York, employ two men on a shift.

● Because of ill health, Pat Oakes and Israel Rubin, veteran members of Houston Local 279, retired from their theatre jobs. Oakes worked at Loew's Theatre since its opening in 1926 (wonder if they will do anything for him under the Loew's pension plan), and Rubin, former secretary of the local, was employed for many years at the Iris Theatre. L. W. (Cotton) Merchant replaced Oakes, and Ham Hamilton is working on Rubin's former job.

● Chet Myers, financial secretary for Salt Lake City Local 99 died recently at the age of 54. Myers was one of the most popular members of his local and had many friends among the exhibitors in his territory.

● Out-of-town visitors to the offices of I. P. during the past few weeks: Robert Pulman and John M. Carson, projection and sound chiefs, respectively, for Gaumont-British Pictures, who have come to this country to check up on the latest technical developmens in the industry; Edward Dietch, Boston Local 182; Walter Kunz, Houston Local 279; Floyd Spencer, Rochester Local 253; Albert Ryde, Buffalo Local 233; and Igor M. Tornovsky, RCA's chief engineer in China.

● Remember Andrew Jackson Higgins, an obscure boat builder from New Orleans who made millions during the war building landing craft for the government? At the height of his operations he was lavish in his praise of the A. F. of L. labor unions, stating publicly that without their cooperation he would not have been able to achieve his sensational success. When the war ended, however, Higgins changed his tune and became violently anti-union, closing his plants in an effort to force his workers to accept the open shop. He inserted full-page advertisements in the newspapers, denouncing organized labor and demanding restrictive legislation.

Well, it is now Mr. Higgins' turn to be put on the pan. U. S. Attorney General Tom Clark has charged Higgins and his associates with making fraudulent statements regarding financial transactions with the government. Mr. Clark declared that they concealed and covered up by "trick, scheme, or device, material facts . . . and made false bills, receipts,

25-30 Club Notes

The 1946 winter season opened with the usual get-together of old-timers. The novel feature of the opening meeting was a delegation of members' sons who joined in a discussion on how to establish a closer relationship between the youngsters and their elders in the interest of mutual progress.

Bob Goldblatt, the first president of New York City Local 306 and an honorary member of the Club, made a donation of $1000 to be used for any purpose the Club elects. Needless to say, Bob received an ovation for his generosity.

Tony Boscarelli, business agent of Jersey City Local 384 was obligated to membership. He made a brief address which was warmly received by the members.

John Martin, secretary of Local 277, Bridgeport, was another out-of-town visitor who seemed to enjoy the Club proceedings.

P. A. (Mac) McGuire, also an honorary member, was on hand informing all within earshot that the Simplex factory was now completely removed to its Bloomfield, N. J. plant.

claims certificates and affidavits, knowing that these were fraudulent statements." The Higgins group is now faced with a Federal Grand Jury investigation of its wartime activities.

● We should like to clarify an item that appeared in these pages last month anent the new agreement signed between New York City Local 306 and the Independent Theatre Owners Association. Despite the fact that the existing contract had another year to run (August 1947), the union officials, taking into consideration the rapid rise in living costs, reopened wage negotiations with the ITOA with the result that a new contract was agreed upon giving the men an increase of 15% retroactive to May 1, 1946, 15 months prior to the expiration of the original contract. Provisions were also made in the new contract for the reopening of wage negotiations in September 1948, with the stipulation that only "upward" wage discussions would be permitted. The exhibitors also agreed to take up with the union officials in 1948 the matter of social and welfare benefits for their projectionist employes. This agreement was reached prior to the address of William Green, A. F. of L. president, at the recent Chicago A. F. of L. Convention in which he urged that all union contracts carry such provisions.

Herman Gelber, president; Steve D'Inzillo, acting New York business agent, and Ben Scher, Brooklyn business agent, negotiated for Local 306. In our opinion these men did a fine job and are deserving of a vote of thanks by the membership.

25 years ago—October 1921

● "In my opinion, high wages are the most economical thing in industry," said Charles A. Eaton, manager of the Industrial Relations Department of General Electric Company's National Lamp Works, in a statement to the press. . . . Road calls were issued against the Valentine Theatre in Defiance, Ohio and the Crawford Theatre in Wichita, Kans. . . . The "open shop" movement suffered another setback when the Railroad Board declared that the Pennsylvania Railroad Company had to deal with labor unions as organizations. . . . Supreme Court Judge Selah B. Strong of Brooklyn, N. Y., denounced the opposition of organized labor to the "open shop" as un-American and not to be tolerated by the American people. . . . The Burlesque Wheels complained of poor business for the past season and tried to get the performers to consider wage reductions. . . . Los Angeles Chamber of Commerce estimated that $20,000,000 was invested by the picture companies in properties and studios. The film industry was credited with a weekly payroll of $500,000, leading the list of some 3300 industries considered in its report. . . . Because of the opposition of theatre owners in Danville, Va., the I. A. local in that city was compelled to disband. The efforts of the International Office were renewed, however, with the result that the local was reorganized and a satisfactory agreement reached with the exhibitors. The local —No. 563—is still operating. . . . An argument ensued between San Francisco Local 162 and I. A. President Jim Lemke because of a letter sent out by the Keith interests. The letter was termed "scurrilous" by Lemke. . . . George H. Jones was secretary of Toronto Local 173, an office he still holds. . . . The United Textile Workers sent about forty organizers into the Southern area for the purpose of conducting an extensive organizing campaign. . . . The road show "Not Tonight, Josephine" closed suddenly owing I. A. members $395.62. . . . New York City theatres were assessed a valuation of $53,215.000—with more theatres to be built. . . . Among I. A. local unions signing one-year-contracts were the following: 136, Hamilton, Ohio; 182, Boston, Mass.; 111 and 256, Lawrence, Ill.; 89 and 382, Holyoke, Mass.; 96, Worcester, Mass,; 198, Bangor, Maine; 522, Quincy, Mass.; 392, Kewanee, Ill.; 482, Champaign, Ill.; 202, Waterloo, Iowa; 575, Pottstown, Penna.; 318 (now 488) Harrisburg, Penna.; 307, Philadelphia; 394, Appleton, Wis.; 63, Winnipeg, Canada; 244, Newark, N. J.; 616, Meridian, Miss.; 619, Alexandria, Va.; 297, San Diego, Calif., 540, Baton Rouge, La.; 102, Evansville, Ind.; 338, Watertown, N. Y., and many others. Most of these contracts were negotiated by I. A. representatives, then called organizers.

● Harry Barco, business representative for St. Louis Local 143, reports the signing of new contracts with the two leading supply houses in St. Louis, namely, National Theatre Supply Co. and the Cine Supply Co. The contracts call for the hiring of Local 143 men to supervise the installation of all projection and television equipment sold by these supply houses, and to instruct in the operation and maintenance of such equipment. The contracts are to run for two years, beginning October 1, 1946, and are based on a forty-hour week. The salary for the first year is $125 per week, per man, and for the second year $150 per week, per man. Additional features of the contracts are two-weeks vacations with pay each year; all expenses paid when outside the local's jurisdiction, and an allowance of 6¢ per mile to each man for the use of his car when on duty.


Harry Barco

George McDonald, member of the local since 1910, was chosen to fill the position with the Cine Supply Co., and Joseph Schrempp, local member since 1908, was assigned to the National Theatre Supply Co. These men were chosen because of their outstanding qualifications for this type of work, states Barco, who is a firm believer in placing the right man on the right job.

The 16-mm field also is receiving considerable attention from Local 143 officials. One difficulty the local had to overcome was the competition offered 16-mm companies by union men owning 16-mm equipment. The situation aroused the resentment of the companies who refused to engage men who were in competition with them. This has been eliminated and today no Local 143 man is permitted to show 16-mm pictures unless the job comes through the local union offices. A more cooperative spirit now exists between the 16-mm companies and the union, with the result that there is a steady increase of work in this field for the members. Here, too, the men chosen for 16-mm work are specialists and concentrate on that type work. Again, it has been proved that the right man for the right job pays dividends.

At the present time Local 143 holds exclusive contracts with four 16-mm companies in St. Louis. The latest to sign up is the Swank Motion Pictures, Inc., the largest portable employer in that city. This contract calls for the engagement of a full-time projectionist at $80 per week, with a maximum of ten projections per week. Two weeks vacation with pay each year is one of the features of this contract.

The foregoing merely bears out Barco's contention that if the individual locals would bestir themselves and make serious efforts to organize their territories, the 16-mm field would not present an insurmountable problem. St. Louis, Los Angeles, Cleveland, Chicago, and many other I. A. local unions throughout the country tackled this field with considerable success and there is no reason why all local unions can't be equally successful.

● Bob Dennis and Gene Mueller, members of San Antonio Local 407, are building their own motion picture theatre in San Antonio. Bob, whose brother John is business agent of the local, works as projectionist at the Texas Theatre, a position he has held for a good many years; and Gene, who is treasurer of the local, is employed at the Majestic Theatre. Bob and Gene were partners in a

(*Continued on page 33*)

The Technicolor Cameraman

By WINTON HOCH
Technicolor Motion Picture Corporation

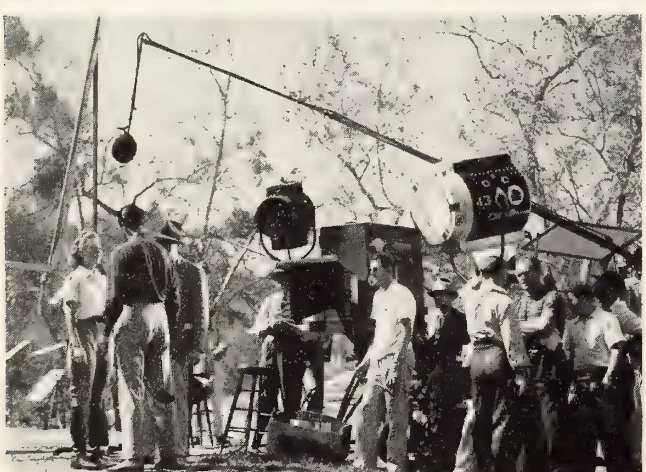
PRESENTED here are some aspects that are peculiar to, or receive emphasis from, the fact that the camera is photographing in color. These aspects arise in very large part before photography, and of all the preparations before the actual start of photography, two that are very important to the Technicolor cameraman are color design of the sets and costume color selection. The importance of proper color design and costume color selection can not be overemphasized. The set colors should be chosen with care for hue, chroma, and value, and with a knowledge of the costumes to be used, the relative importance of the set, its cutting and physical relationship to the other sets, and the orientation of these factors with the script. While it is true that the cameraman can control the set effect to a large extent by his lighting of it, this color control work must be carefully handled or the screen result will not be optimum. Obviously, the more adverse conditions the cameraman meets the more the production is likely to suffer either in screen result or lost production time to correct those adverse conditions, or both.

These two factors of set and costume color probably go farther than any other group of factors in representing the difference between a black-and-white production and a color production. The net result might be termed the "color score" of the picture. It might be compared with a musical score sometimes flashing and brilliant and at other times subdued. It follows that if the problem be ignored, discords usually occur.

Some Factors Affecting Make-Up

Obviously, without sets and costumes in color, the only colors left are flesh tones. A very interesting color emphasis effect was demonstrated where an entire set was designed in neutral tones and the star wore the only color. To handle this very important set and costume color contact, Technicolor has available the services of a color control department to advise on the color design of the sets, the evaluation of costume colors, and allied problems. This department's experience and highly developed judgment are available to each new production as it comes along. This department is the spearhead of the Technicolor photographic activity.

On location in Maryland with Loretta Young. Henry King, directing; Ray Rennahan, photographing.



The make-up problem is handled, as in black-and-white pictures, by the studio make-up departments, although the color cameraman does have the responsibility of requesting the "touching up" of the make-up as it may be necessary, and he very often has special problems that require close collaboration with the make-up man. For instance, on exteriors with the actors working in sunshine, they usually begin to sunburn, and make-up changes must be made in many cases to handle these gradually-tanning complexions. Frequently this means a new make-up problem in order to keep the camera appearance of the flesh tones the same. It can readily be seen that this can become a difficult job. The reverse is also true. As the troupe begins stage work after returning from the exteriors, their tanned skins will slowly fade and the problem of compensating by make-up continues. Occasionally we have had difficulty due to physical exertion on the part of the principals, causing faces to flush beneath the make-up which affects the camera appearance.

The color camera is very discerning of flesh quality, and we find it necessary to include in the make-up area the neck and throat, and the hands and arms if they show. On rare occasions no make-up at all is used, and it is frequently omitted when photographing babies, as their clear smooth skin generally needs no correction.

Light Quality Level All-Important

It should be kept in mind that, generally speaking, the primary function of make-up is to correct extremes in colors, cover blemishes, and generally reduce the tone range observed in any average group of persons. If one will note the varying complexions of people, he will readily appreciate that if three or four persons were lined up side by side to be photographed, it would be highly desirable and probably very necessary to correct the flesh tones and greatly reduce the tone spread. This must not be interpreted as meaning that all flesh tones should appear alike. Variations of tone are very desirable. It is the extremes that are undesirable. Obviously, a white man with a heavy tan who photographs like an Indian is not a very convincing white man. The most critical care is given to the close-ups, especially of the principals. The care and attention given to the problem are, of course, directly proportional to the screen importance of the skin tones. Proper make-up requires highly skilled artistry in its application.

Other important items to the cameraman are his lights. Here, color photography again introduces an important factor of which the cameraman must be cognizant, and

which must be watched very closely on certain types of work. That factor is color-temperature. Our present three-strip Technicolor cameras are balanced to an average daylight color-temperature. For true color rendition, especially in the pastel shades and neutral grays, this temperature should not vary on the set by more than about ±250°.

There has been in the past some misconception regarding the status of incandescent lamps ("inkies") with respect to Technicolor photography. Some people have understood that the Technicolor cameras are changed over by filters and prisms to accept an unfiltered incandescent-lamp color-temperature. Others have indicated that they thought that the camera automatically corrected any unfiltered inky light that might be added to an arc-lighted set. These conceptions are wrong.

The filters, prisms, and film of our present three-strip Technicolor camera are all balanced to daylight and this balance is used both for exteriors and interiors. This simplifies the production problem a great deal. First of all, there is manufactured and used only one set of film emulsions. This means that manufacturing, ordering, shipping, storing, exposing, and developing are all standardized for one system, with all the obvious attendant advantages, not the least of which is a lower negative cost.

This single standard also simplifies set-lighting problems, both interior and exterior. All regular Technicolor lighting units have been balanced to this daylight color-temperature by actual and repeated tests with the Technicolor camera. Therefore, they may all be used interchangeably as far as color-temperature is concerned. The only other factors governing their use are the very direct functional ones such as size of unit, light output of unit, operational characteristics of the unit, the type of light that it gives (that is, whether a "hard" or "soft" light) and the unit efficiencies with respect to light output *vs.* current input, and with respect to light output *vs.* the throw required of the unit for the particular job in hand. The more common units used for general production are (HI = high intensity):

The 150-ampere HI arc, the 120-ampere HI arc, the white-flame twin broad arc, Inky Sr. spotlight, Inky Jr. spotlight, and the Inky baby spotlight. Among others less frequently used but in many cases no less important should be mentioned many special converted lamps, a 65-ampere HI arc spot, and a 10-kw corrected inky lamp.

The light-sources used for photography might be classed in four general groups as follows: daylight, high-intensity arc, white-flame arc light, and incandescent light.

Perfect Color Balance Required

Daylight, of course, is our standard for color-temperature. The HI arc lights are all corrected for normal work with a *Y-1* gelatin filter placed in front of the arc light. This filter was especially made for Technicolor, using a special non-fading yellow dye supplied by us. The exact filter strength is determined by camera test. The white-flame arcs were balanced to a daylight color-temperature by National Carbon Co. and therefore require no filter of any kind. The incandescent lighting units must fulfill two requirements to meet the daylight color-temperature standard. They must first be equipped with incandescent bulbs burning at a color-temperature of 3380° K; second, they must be fitted with a tested Macbeth glass filter. All General Electric bulbs marked *C.P.* will burn with a color-temperature of 3380° K when operated at their rated voltage. It should be emphasized that the rated voltage must be supplied, and in the case of the arcs, the proper amperages and proper gap lengths and positions must also be maintained.

Daylight as a source probably presents fewer troubles, although very early in the morning and very late in the afternoon trouble is frequently encountered. An interesting difficulty occurred early one afternoon when the smoke from a forest fire filtered the sunshine to such a brownish-orange hue that it was necessary to abandon the location for that day.

The conditions just outlined do not have to be met at all times, but they should be adhered to if a pure white light is necessary and desirable for the work in hand. Certainly there is no limit to the effects obtainable with colored lights. For instance, frequently straight unfiltered flickering inky lights are used to produce a warm glow on the costumes and faces to simulate firelight. Artistic sense and experience must dictate the extent to which colored lights are used. The colored-light possibilities have been frequently exploited.

The rigging and lighting of a color set is similar in many respects to that of a black-and-white set, with the exception that lighting units balanced for Technicolor are the units used, unless effects are in order. Most Technicolor sets rely upon arc-light units for the bulk of the lighting. The large sets especially use the larger arc units. Some of the very small sets are from time to time lighted entirely by corrected inky light. Inky units are valuable also on big sets as auxiliary lighting units. They must be watched for age and cleanliness, as an aged bulb and a dirty reflector, filter, and lens can substantially reduce the lamp output. Needless to say, cleanliness is also an asset with arc-light lenses, and proper maintenance and servicing of all lighting units are important.

Exterior sets and set-ups are also handled in a very similar manner to black-and-white set-ups. Scrims, nets, reflectors, and booster light all play their part. It should be noted that the so-called gold reflector is not acceptable in color work (unless for effect) for obvious reasons.

The color-temperature factor is once more introduced when reflectors are extensively worked. The term *daylight* has been advisedly used. By definition daylight is

Winton Hoch ready for takeoff to photograph scenes for sensational all-color film "Dive Bomber."

the light from the entire sky, including direct sunlight if the sky is clear. Sunshine has a color-temperature of about 5,500°K, while blue sky has a color-temperature varying from 10,000° to 20,000° K. When reflectors are used as lighting aids they select only the sun, which is reflected into the scene, and introduce a filler light that is warmer in tone than daylight. In addition, it must be remembered that the so-called silvered surface, which is usually aluminum or tin, reflects slightly less blue than it does red and green. This factor also adds slightly to the effect of a lower color-temperature. For these reasons reflectors are not considered as desirable as booster light for some purposes. This is especially true of close-ups where flesh quality is of critical importance.

Technicolor Process Photography

Process photography in Technicolor is now largely a matter of routine. The scenes selected for process work are, of course, subject to the usual limitations for that type of work, but astonishing results have been obtained. Progress in this field can be largely attributed to two factors: improvement in plate quality, and improvement in background projector equipment.

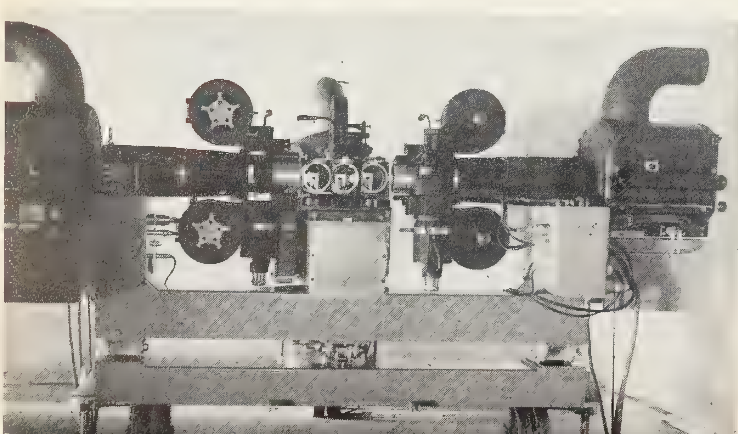
It has been found that background projectors vary appreciably in the color-quality of the projected light. Generally speaking, the projectors using reflectors have a little more blue in the light than the condenser projectors, although this color-quality varies appreciably depending upon the condition of the reflector and the nature of its surface, or upon the glass used in the particular condenser set-up in use. Some condenser lenses have a very pronounced yellowish cast that is not very desirable for color work.

There has been appreciable pressure in the last few years aimed at increasing the background projector outputs. The present high outputs have resulted from improvements in carbons, objective lenses, projector optics behind the objective lens, and lamphouse, and in the successful combination of several projectors for throwing super-imposed, matched, and synchronized images onto the process screen. Astonishing progress has been made toward increased output, and fortunately these developments reached the point where they were incorporated into production equipment before the war appreciably curtailed progress in this line.

Many studios and equipment companies have all contributed to this projector improvement problem. As a result, we very frequently photograph screens in color more than 20 feet wide, and have photographed, in color, process screens approximately 28 feet wide. A shot was made by Paramount using a split-screen including a total camera spread of 50 feet. This was accomplished with the aid of two triple-relay projectors incorporating the recent improvements previously mentioned. In this emphasis on large screens it should not be forgotten that miniature screens also have their uses, and can be successfully handled on the same general basis as the large screens.

Example of the successful combination of projectors for throwing super-imposed, matched and synchronized images onto the screen. This Paramount Studio triple projector utilized three prints to cover a 50-foot screen for a background transparency shot.

Courtesy Farciot Edouart, Transparency Dept., Paramount Studios



The problems faced by the color cameraman in handling process photography are generally about the same as those found in all process work. However, he must be very color-conscious and on his guard against an off-color projector light and improperly burning foreground lights. He must also be very careful of his foreground-to-background balance, as a background that is carried too high will often present a burned-out appearance that greatly alters the color values of the plate, and destroy the illusion of realism that he is striving to create.

Modern Technicolor camera equipment closely parallels the black-and-white studio equipment in its principal operational features and functions. There are available, for the camera, lenses of 25, 35, 40, 50, 70, 100, and 140-mm focal lengths. They are all in carefully calibrated mounts that fit onto a master focusing mount on the camera. In almost all cases focusing is accomplished by actual measurement to the focal plane desired, and then the lens is set on this indicated calibration. Repeated tests have shown that this method is more accurate than eye focusing. Eye focusing is seldom resorted to unless the focal distance is so short that it exceeds the lens calibrations.

The camera motor arrangement is highly flexible and worthy of special note. There are eight types of motors and eight combinations of motor-to-camera gears, all of which can be changed in the field. The only requirement of the cameraman is to specify the kind of shooting expected and the electrical current or the kind of distributor system to be used. The regular cameras can also be successfully operated running backward at full speed. Speeds higher than 24 pictures per second, either forward or backward, are not permitted with the standard cameras.

There are many items of special equipment available to the Technicolor photographer that are far too numerous to mention in detail. Among them should be mentioned, however, the variety of equipment and mounts used for air photography; the camera blimp and mounts used for underwater photography; and the speed-cameras capable of consistent operation at so-called six times normal speed, or 96 pictures per second.

Camera Difficulties Exaggerated

The question has been asked if an extra standby camera was kept on the set at all times to replace the camera in use when the film ran out, because it took so long to thread the Technicolor cameras. This is not true. The actual threading time of a Technicolor camera is only about three minutes, for a skilled technician, and many units work with only one camera. On major production units, however, an extra camera is usually kept on hand, threaded, to prevent any possible loss of production time

(*Continued on page* 34)

16-mm PROJECTIONS

A Tremendous Trifle—The 16-mm Film Splice

A FILM splice is a little thing, and being little it has been given little attention, states a report of the S.M.P.E. Subcommittee on 16-mm film splices. If we are to take heed of the advice of our Scotch friends, continues the report, we must remember that "many a mickle makes a muckle—" and pay more attention to our splices. Other interesting excerpts from the committee report are appended:

We must remember that splices have a number of functions: one of the most talked about is that of repairing a torn film. If a film becomes torn in use, it is either worn out or it has been subjected to carelessness in handling or run on a poor machine. Despite the proverbially poor operating condition of 16-mm machines, film damage seems surprisingly low for the amount of film projected, if one judges by the insurance rates in force for most circulating libraries.

It should be noted that an unspliced print will normally show an appreciably longer life than a spliced print, particularly on machines with sharp bends in the film path.

Picture Area Encroachment

Customarily, a 35-mm splice is made in the negative and is of such width that no portion of it appears within the 16-mm projector aperture when a reduction print is projected. Although 35-mm picture originals almost invariably are negatives, 16-mm picture originals are almost invariably reversals or direct positives. Good examples are Kodachrome, Ansco Color, and black-and-white reversal original. It is only in special cases that negative is used as original material.

If we examine a 16-mm splice made with any present-day commercial splicing machine we invariably find that the splice encroaches upon the picture image appearing in the projector aperture. Fig. 1 shows the amount of encroachment involved with splices of two different widths, namely, 0.070 inch and 0.100 inch.

Our 16-mm splice *does* encroach with *either* dimension—quite a different situation from that encountered with 35-mm. Needless to say, the diagonal splice is located diagonally across the spliced frame in the aperture.

Even if we are extremely careful in making splices, either splice appearing in the original will appear in every release print made, because of the encroachment. As present 16-mm subjects of commercial origin may have as many as 150 splices in a single 400-foot roll (and it is not unusual to find 80 as a typical average) the importance of making every splice a good unobtrusive one can hardly be overemphasized. Fortunately, splices made in original reversal and in color reversal show up much less objectionably than like splices made in original negative material.

Straight vs. Diagonal Splices

If 0.070-inch straight splices are neatly and cleanly made, they will be almost invisible in the release print, particularly if the edges of the splice are carefully painted out or "blooped" in the assembled original film. (Blooping may be the incorrect term as we refer here to treatment of the pipcture and not of the sound.) Needless to say, the 0.100-inch straight splice and the 0.070-inch diagonal are not capable of a neat and workmanlike result when compared with the 0.070-inch straight splice.

The situation with regard to splicing the sound original is different from that of the picture original. In the past, most 16-mm sound originals were recorded as nonpush-pull negatives. We may expect a very material increase in the number of direct sound positives in years to come. Most 16-mm sound originals fortunately are *not* recorded simultaneously with the taking of the picture but are scored *afterward* (with off-stage voice) in accordance with the timing established by means of a "shot list" (cue sheet) made from the picture.

With a competent staff and with suitable recording facilities, there is little reason for more than 2 or 3 splices. One of these is used to attach the head leader to the original and another to attach the tail leader to the original. If more than these 2 splices are required, a sound bloop will be needed for each additional splice.

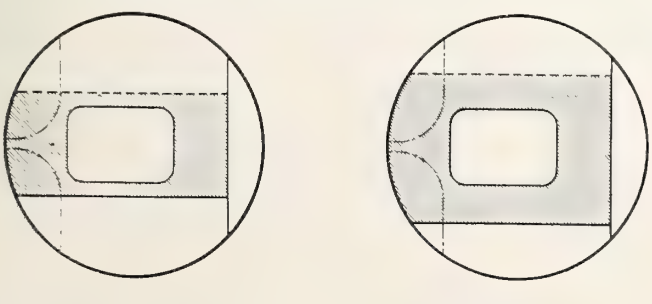
Human Variable Important

For the present we may say that it is customary in most cases to use the same kind of splice for original sound as for original picture. The procedure, however, must be recognized as an arbitrary one since the diagonal splice has certain advantages in splicing sound film.

Subcommittee records show clearly that the splice problem is in need of considerable study. One very significant point of difference in thought was that with most existing splicing equipment the quality of the splice made depends to a very great degree on the skill and dexterity of the operator.

Shall we consider the amateur as a typical user to be governed by our standard, or shall we consider only a professional specialist? The Subcommittee agreed that a standard was needed and that continuing work would be required to obtain a satisfactory answer. Possibly the best solution is to eliminate the human variable entirely by means of an automatic splicing machine.

The lowly splice is one of the biggest little things in motion pictures. 400 million feet of 16-mm film a year is too big an item to be ignored, even though we may choose to ignore the 2 million or more splices that appear in that footage.



Relative 16-mm splice encroachments on picture area; (left) 0.070-inch splice; (right) 0.100-inch splice.

Joint TESDA-TESMA Convention Set for Toledo Nov. 8-11

All is in readiness for the joint convention of The Theatre Equipment and Supply Dealers Protective Association and the Theatre Equipment and Supply Manufacturers Association in Toledo, Ohio, on Nov. 8-11 inclusive. Excellent facilities have been arranged at the Secor and Commodore Perry hotels, where participating members are assured hotel accommodations and exhibit space. Present indications are that more than 80 manufacturers will exhibit equipments.

Last-minute arrangements may be checked through either Oscar Neu, 427 West 42nd St., N. Y. City, 18, or Roy Boomer, 4356 West Washington Blvd., Chicago, 24. Projectionists within reasonable travel distance of Toledo are cordially invited to attend the convention for at least one day.

OPA Lifts Lighting Controls

Price controls over film lighting equipment and other electrical units have been lifted by the OPA. All klieg-type lights, including arc and incandescent lamps and lighting equipment designed solely for use in the production and projection of motion and still pictures, were removed from OPA control. Action was accompanied by OPA opinion that it did not look for any sharp rise in prices on these items.

British Photographic Exhibition

The Birmingham (England) Photographic Society will hold its 51st International Open Exhibition from Feb. 1-15, 1947, entries to by judged by Alexander Keighley. Entry forms available from L. Vernon Bates, 41 Spies Lane, Birmingham 32. Entries close Jan. 7.

S.M.P.E. Recommends Larger Diameter 35-mm Projector Sprocket

FOR many years a discussion has been active relative to the possible advantage of a 16-tooth intermittent projector sprocket larger in diameter than the 0.935-in. value now in use with 35-mm film, reports the S.M.P.E. Standards Committee. Laboratory tests have consistently indicated a much longer film life with a larger sprocket, but the practical application of such a sprocket had never been successfully accomplished.

As long ago as 1930, American Standard *Z22.35* called for a diameter of 0.945 in. However, when this larger size was supplied to the trade in 1934, many complaints of noisy operation arose, attributed to sprocket wear by the film. Consequently, an expensive reversion to the 0.935-in. diameter followed with the result that *Z22.35* has never been a truly observed Standard.

In the recent war emergency the necessity for film conservation was responsible for a renewed consideration of this subject. A special S.M.P.E. Subcommittee on Intermittent Projector Sprockets for 35-mm Film was formed under the chairmanship of Dr. E. K. Carver for this purpose.

The committee had laboratory data indicating that at least double the film life could be obtained through the use of a larger sprocket. The problem was to determine how such a sprocket would stand up in service and if the initially apparent increase in film life persisted throughout sprocket life.

After extensive tests with sprockets of several diameters in a number of theatres, the subcommittee found that the initial film saving does persist, and that sprocket wear is in no case faster and in many cases much slower than with the present 0.935-in. diameter sprocket. Increased projector noise, a possibility originally the subject of much controversy, was simply nonexistent. The parent Committee has since approved by letter ballot the subcommittee's recommendation of an 0.943-in. diameter.

New 16-mm Commercial Kodachrome for Improved Color Prints

A new 16-mm Kodachrome motion picture film, yielding release prints of improved color quality and offering greater exposure latitude than that of existing Kodachrome Films, has been announced by the Eastman Kodak Co. Designated as Kodachrome Commercial Film, the new film will produce a low-contrast original from which release prints are made. Prints made from this original provide color contrast equal to that of good originals made on other types of Kodachrome. At the same time, the film's increased latitude assures proper gradation of highlights and shadows.

Originals on Kodachrome Commercial Film are not designed for projection. A Kodachrome print is recommended for projection, cutting, and editing. Such a print may be ordered at the time the original is processed, making a projection print available when the original is returned. After the editorial work has been done on this print, the original film can be cut to match it. To facilitate this, all Kodachrome Commercial Film is edge-numbered with latent image footage numbers at 40-frame intervals.

Sound may be recorded on a separate film at the time the picture is made or may be recorded before or after, as circumstances require. It cannot be recorded directly on Kodachrome Commercial Film; the film is supplied only with perforations on both sides.

Since variations in the over-all color rendition of an original may be increased slightly in duplication, all film for a given production should have the same emulsion number and should be obtained at the same time. The cost of processing is included in the purchase price. Processing will be done in Rochester, Chicago, Los Angeles, and New York. The film is available only in the 16-mm width in rolls of 100 and 200 feet.

Telefilm Studio Stock Issue

Telefilm Studios, Hollywood, will float a $1,500,000 stock issue, first in its history, with shares having a par value of $10. Proceeds of sale will go for expansion of facilities. 1946 gross business reported at twice that of 1945.

VIDEO AND MOTION PICTURES

(*Continued from page 6*)

radio and motion picture industries are full of living, walking, breathing illustrations of the danger. People tend to specialize on one job and never learn about the rest of the business. This puts an artificial limit on the development of the technician or artist, as well as on the medium itself—tending to result in a mass-produced "art" product without individuality or distinction.

This danger is no more acute in motion pictures than in television. In the former there is a long period of time elapsing between the moment a film is "shot" and the time the audience sees it. A great many different people can do a great many things to the film after it has left the director's hands, and in many cases he has nothing to do with the editing, which is the basic process of the film.

In television the entire production is created and distributed at the same time. The director has a much greater opportunity to put his own stamp on the show, and after it leaves his hands no man alters it. By the same token, every cameraman, soundman and artist exercises a direct control on the program. If he be expert, a cameraman can put his own stamp of individual artistry on a production. Conversely, if he be inexpert or unreliable, one man can destroy an entire production.

Television Requisites Severe

In the production of motion pictures, teamwork, cooperation, and efficiency are necessary in order to avoid excessive production costs. In television these qualities are necessary for the same reasons and are vital if the destruction of a program's effectiveness is to be avoided. But good television demands even more. It demands a perfect working harmony between all members of a production crew, in precisely the same way that this is demanded of a bomber crew—and for precisely the same reason: if one man slips, the venture is finished; there are no retakes.

On the other hand, the dangers of mass production on unimaginative formulae are as real in television as they are in radio. Television will use many more hours of entertainment than the motion picture industry distributes, perhaps as much as standard radio, and a good many of these programs will undoubtedly slip into ruts just as in radio.

One of the surest ways for a technician or artist to avoid the dangers of stagnation through lopsided development is to get a thorough grounding in all branches of television before specializing in any one branch. Now, that would seem to be a perfectly obvious thing to do. It is a procedure followed in most schools, but unfortunately very few people have the inquisitiveness or opportunity to follow this practice after they leave the campus.

Let the reader take any business, for

example, whatever occupation he may have, and figure out how many of his associates have tried to learn everything they can about all phases of their business. The chances are that the percentage will be low.

The problem is particularly acute in television today, for the simple reason that there has been almost no opportunity to learn about programming. All of which leads to the conclusion that prospective television broadcasters will find it a highly profitable investment to set up on a large scale laboratory studios in program development for the training of their future program workers on a professional basis.

Tele and Film Similarities

Checking through some of the more obvious similarities between motion pictures and television, we find that both appeal to the same senses, seeing and hearing, via moving pictures and electrically-reproduced sound. In both, the picture system is monocular and the sound system monaural. Motion pictures started out by being entirely monochromatic, with color pictures gradually introduced at a later date. Television seems to be following the same pattern.

The motion picture reaches the audience as a varying pattern of light reflected from a flat white screen. Since the theatre auditorium is usually darkened, the ordinary picture has a screen brilliance of about 12 foot-lamberts. Television receivers are usually observed in a partially lighted room and therefore need a brighter picture. With the prewar television system the picture could sometimes have a brilliance up to about 20 foot-lamberts, and it reached the viewer either as a varying pattern of reflected light (in a projected picture), or as a varying pattern of direct light (in a direct-viewing or mirrored tube).

The contrast range of the television picture—in the varying shades between white and black—was comparatively restricted on prewar receiver tubes when compared with the contrast range of motion pictures. However, with continually improving equipment it is possible to get a contrast range comparable to what is normally in motion pictures.

The same situation applies to the sensitivity of the television camera. Prewar cameras needed very intense illumination, especially if any satisfactory depth of focus was to be obtained. To get a really good picture one needed somewhat more light than was necessary in motion pictures, but newer cameras are progressively more sensitive to light.

The problem of flicker is unimportant in motion pictures and in television. Silent pictures were projected at a frequency of 16 pictures per second. Below that frequency the eye could detect an objectional flicker. When sound pictures came in, the picture frequency was raised to 24 per second, or 90 feet of film per minute.

In television the picture frequency is considerably higher: 60 "half-pictures" per second interlaced to form 30 complete pictures. This figure was selected for American television primarily because most electric current supply in the United States is 60-cycle. In England, where current is 50-cycle, the television system has 50 "half-pictures" interlaced to form 25 complete pictures per second. And in any country, television, like motion pictures, depends upon *persistence*

of vision to achieve the illusion of motion.

In definition, the amount of detail in the picture in prewar television was theoretically capable of a picture better than 16-mm film but not as clear as that of 35-mm film. Detail in ordinary 16-mm film is roughly comparable to a 375-line television picture. A 35-mm film is about the same as a 700- or 800-line picture might be.

Television standards, as set in 1941, call for a 525-line picture, but most transmitters and receivers operating during the wartime period could not reproduce a picture of more than 350- to 400-line definition. Many prewar sets were designed in 1937 or 1938 and by the end of the war were pretty well worn out, some of them giving no more than the equivalent of about a 250-line picture.

Comparative Image Detail

Since the amount of detail in a picture is governed by the number of picture elements in it, it might be noted here that the average 16-mm motion picture contains about 125,000 picture elements. A 525-line television picture, on a 6-megacycle channel, can have about 250,000 picture elements; and a 35-mm motion picture has approximately 500,000.

It should be noted also that there is a point at which the human eye does not appreciate added detail—the law of diminishing returns applies. When the television picture was raised from 343 lines to 441 in the mid-1930's there was a much more noticeable improvement in the picture than when it was raised from 441 to 525 lines in 1941. The improvement in going from 525 lines to somewhere around 700 lines would presumably be slight, almost unnoticeable to the human eye unless the picture is viewed at very close range, or unless it is viewed on a large motion picture theatre screen. [Screens of this size obviously will not be used in homes. Most home receivers have screens ranging up to not more than 3 by 4 feet.]

The shapes of the television pictures and the motion picture are the same. Each has an *aspect ratio* of 3 by 4, which means it is three units high by four units wide: *i.e.*, 3 feet high by 4 feet wide, or 18 inches high and 24 inches wide, or 15 by 20 feet.

[*To Be Continued*]

MORE THAN WORDS . . .

"Everybody Benefits — Everybody Gives" is more than a slogan. Your local community Chest Red Feather Services help to provide your citizens with health and hospital care, education and recreation facilities, and family and child welfare guidance and help.

Keep it up — don't let them down! This, too, is more than a slogan. For USO still has a big job to do in serving the new inductees, the convalescent wounded, garrison troops, and in providing USO-Camp Shows in hospitals. Give generously to the USO and your Community Chest.

S. M. P. E. PAPERS ABSTRACTS

(*Continued from page* 14)

motion picture industry that the coated recording media can be perforated to obtain synchronization between picture and sound. It is also possible to apply the magnetic coating directly to the film base.

The magnetic characteristics of the plated and coated materials are such that it is possible to obtain a good frequency response with relatively slow speed of the recording medium. With a wire speed of 2 feet per second, it has been found possible to cover a range up to 6500 cycles; and with a paper tape speed of about eight inches per second, frequencies up to 5000 cycles can be handled. With the coated material it is now practical for low-fidelity applications to record sound tracks in close proximity.

PRACTICAL PROBLEMS OF 16-MM SOUND

By *Allen Jacobs*
The Calvin Company, Kansas City, Mo.

As a service organization for a large number of 16-mm producers in this country, we are constantly impressed with the obvious lack of adequate equipment for making good 16-mm sound. This paper is a plea for a general improvement in the engineering management and design of sound channels for 16-mm recording.

This paper, recognizing this lack of availability of specialized 16-mm equipment, describes the practicability of adapting standard broadcast and disc recording equipment to 16-mm work. This may first seem obvious, but many 16-mm producers still think that a 16-mm recorder requires a 16-mm amplifier.

While we can't buy perfected 16-mm recorders and film phonographs, we can surround these inferior pieces of equipment with finely engineered sound channels for recording and reproducing that will represent fine quality for years to come.

A COMBINATION SCORING, DUBBING AND PREVIEW STUDIO

By *Daniel J. Bloomberg* and *W. O. Watson*
Republic Studios, Hollywood, Calif.
and *Michael Rettinger*
RCA Manufacturing Co., Hollywood, Calif.

This paper discusses the construction of the new Republic scoring stage and includes a description of the electrical equipment used. In the building of the stage, probably the largest scoring studio in the world, esthetic elements were given equal consideration with acoustic factors. It was also deemed important that the enclosure contain all necessary facilities for music recording, such as a dual reverberation chamber with a remotely-controlled door, a vocal room with a large window between it and the stage, two monitoring rooms with concealed speakers, a conductor's podium, an efficient air-conditioning system, etc.

Convex plywood splays were employed in sufficient numbers for the wall contours of the room to achieve the desired reverberation characteristic, care being taken to orient the splays along the three orthogonal axes for maximum sound diffusion. A discussion of the electrical equipment includes descriptions of the different equalizers used in the recording channel, an interlock selector switch panel which controls thirty Selsyn motor circuits, a 12-position dubbing console mixer, and a large number of associated units.

THE SOUNDMAN

By *George R. Groves*
Warner Brothers Studios

This paper outlines the tools and means at the disposal of the motion picture production mixer to enable him to fulfill his prime responsibility of being the director's assistant in all matters pertaining to sound. A parallel is drawn between the work of the soundman and the cameraman. Particular emphasis is placed on the artistic capabilities and qualifications required by the mixer to assure the degree of confidence and cooperation that must exist between himself, the director and the cast in order that "sound" may contribute its full share to the realistic quality of the final product.

THE ACE-REEVES FILM SPLICER

By *Irving Merkur*
Reeves Instrument Corp., New York

Extreme ease of operation the result of decreased operating movements, the virtual guarantee of perfect results, and ruggedness characterize a new film splicer which, incorporating many novel features, is made in 4 models for use in theatres, studios, and for the 8- and 16-mm fields. One model serves both the latter classifications.

Among the features of these units is a stationary blade, film clamps pivotally mounted on each side of the blade, and a shear blade on the under side of each clamp

which works in conjunction with the stationary blade. The lightest finger-touch serves to release the spring-tensioned clamps. A perfectly flat film plate is provided with guide pins which provide precision placement and rigid gripping of the film during the splicing operation. These pins recede below the plate when the clamps are released, thus obviating any possibility of ripping the film when it is removed from the splicer.

A serrated scraper attached to the base of the unit in exact working position insures a clean emulsion scrape over the entire patching area, thus avoiding any unscraped area. Two of the models employ a heating element in the form of a series of coils which induce rapid drying of patches. Space for a cement bottle is provided in the base itself.

DE LUXE FILM RECORDING MACHINE

By *M. E. Collins*
RCA Manufacturing Co.

A power amplifier which provides high quality performance due to utilization of negative feedback over three stages is described. The mechanical design presents a novl and convenient front service arrangement.

COMPOSITION IN MOTION PICTURES

By *Howard T. Souther*
Stephens Manufacturing Co.

The first section of this paper deals with the construction of the motion picture as a static form through the conjunction of lines, tones, masses and perspectives as forming a part of the unified whole. The second section reviews color notation, suggests careful employment of color both qualitatively and quantitatively, and offers guides to combining hues of different chroma, value and area in order to promote maximum harmony and minimum viewer irritation. The third section invites attention to the compositional requirements of time and movement in the motion picture frame. Potential movement is also considered.

A NEWLY DEVELOPED LIGHT MODULATOR FOR SOUND RECORDING

By *Glenn L. Dimmick*
RCA Manufacturing Co.

A new light modulator, recently developed, has very low distortion and greatly improved performance characteristics. The new modulator is of the magnetic type and is mechanically and optically interchangeable with the present RCA sound recording galvanometers. The power required for 100% modulation is 1.25 watts. Distortion characteristics, frequency response curves and impedance data are shown. The effect of bias current upon the performance characteristics is also given.

THE CONCENTRATED-ARC LAMP AS A SOURCE OF MODULATED RADIATION

By *W. D. Buckingham* and *C. R. Deibert*
Western Union Telegraph Co.

The concentrated-arc is a new type of lamp whose radiation-emitting source is a thin film of molten zirconium and a cloud of excited and ionized zirconium vapor and argon gas which forms on and very close to the end of the specially prepared negative electrode. By modulating the lamp current, the radiation may be modulated at audio frequencies.

The continuous radiation from the molten zirconium can be only partly modulated, the percentage modulation decreasing with increase in modulation frequency and increase in spectral wave-lengths. The line radiation from the cathode glow region close to the electrode modulates almost completely at all frequencies. It is particularly strong

in the near ultraviolet and in the infrared.

By using suitable modulator circuits, which are adapted to the rather unusual impedance characteristics of these lamps, and by using optical filters to select the spectral region used, the light output may be made to follow the lamp current modulation with good fidelity.

AN INVISIBLE 16-MM FILM SPLICE

By *Ernest Baumert* and *Joseph V. Noble*

All present 16-mm film splices standardized by the S.M.P.E., while possesing the necessary strength, have the undesirable characteristic of being visible on the screen. A new splice has been developed which does not encroach on the picture aperture area but nevertheless retains sufficient strength for printing and projection operations. This is accomplished by a step-shaped splice which reinforces the edges of the film and is the width of the frame line in the center of the film. The principle, equipment and abuse tests are described.

DETERMINING THE SHAPE OF THE FOCAL SURFACE IN 16-MM PROJECTION

By *F. J. Kolb, A. C. Robertson* and *R. H. Talbot*
Eastman Kodak Company

16-mm projection is becoming more and more professional in its application and it is beginning to be judged by professional standards. One characteristic of 16-mm projection which is inferior to present 35-mm projection is the sharpness of the screen image. A method is presented for describing the shape of the focal surface: the departure of this surface from a plane explains a great deal of the unsharpness of the image. The contributions of the elements of the optical system and the design of the gate are disclosed.

THE MOTIOGRAPH AA PROJECTOR

By *Emil J. Weinke*
Motiograph, Inc., Chicago, Ill.

Motiograph's 50th anniversary is marked by the offering of a completely new professional 35-mm projector mechanism design based jointly on this experience, on careful studies of all previous designs, and on a comprehensive field survey of the features desired by projectionists and theatre owners.

Prominent design features are: the cast streamlined housing with integral center frame; the twin-rotor double rear shutter within the housing cutting the light beam simultaneously from top and bottom only 2 inches from the aperture; a new oil-less lubrication system requiring only semi-annual attention; a newly designed film gate assembly opening forward a full inch for easy threading and with an instantly adjustable film tension control; an illuminated secondary threading aperture, and an extremely rigid and accurately aligned lens mount easily adjustable for precision focusing.

The intermittent movement is quickly removable from the operating side and a new taper pin and steel ball sprocket anchoring system permits all sprockets to be easily reversed or replaced without mechanism disassembly. Film tension shoes, tracks and aperture are likewise almost instantly removable for cleaning. The intermittent movement shafts vertically in a V-rail supported carriage for framing and the control carries a dial to indicate framing position.

Liberal use of the latest and best steel and aluminum alloys for parts and precision machining throughout the mechanism insure excellent and efficient performance, low operating cost and long life.

EFFECT OF FEED AND HOLDBACK TENSION ON PROJECTION LIFE OF 16-MM FILM

By *C. F. Vilbrandt*
Eastman Kodak Company

With the advent of 16-mm cine film into the educational and commercial fields has come the demand for increased projection film life. At the same time, to avoid loose, unsatisfactory winding of the large projection rolls in use today, higher wind-up tensions are required.

The effect of wind-up tension on projection life of the film is described and compared with the effect of feed tension. The importance of the relationship between sprocket pitch, film pitch, and film wear is discussed.

RECENT DEVELOPMENTS OF SUPER-HIGH-INTENSITY ARC LAMPS

By *F. C. Coates* and *M. A. Hankings*
Mole-Richardson Co., Hollywood

This paper will define the terms used to describe various arc lamps, such as flame arc, low-intensity arc, high-intensity arc and super-high-intensity arc. It will cover the

requirements of the industry which call for the development of new super-high-intensity arc lamps and will describe the experimental arc lamp on which the preliminary development work is carried forward.

It will also cover the results of various experiments and tests of super-high-intensity carbons using both water-cooled and air-cooled lamp heads for the positive and negative carbons. It will also give a description of the lamp developed for background projection work and the new 225-ampere lamp to be used for photography on the sets.

A NEW ANSCO ONE-STRIP COLOR SEPARATION FILM

By *Newton Heimback*
Ansco Product Development Labs.

Ansco one-strip color separation film, type 155, available shortly to the motion picture trade, is a new black-and-white film product specially designed for duplication work from color monopack originals. In printing from a color original through tri-color filters, this emulsion has the novel property of giving color separation records of equal contrast for a given development time, thereby permitting simultaneous printing of all three color record cords on the same film.

This new one-strip color separation technic eliminates the cumbersome method of printing and developing each color record individually on separate films requiring critical developing conditions for each record in order to achieve the desired contrast. An even greater operational advantage with the new film is the elimination of registration difficulties due to differential shrinkage which occurs in the preparation of records on separate films by use of present methods.

Ansco one-strip color separation film is a fine-grained emulsion coated on cine grey base having low shrinkage characteristics and possesses special spectral sensitivity which allows the use of the most desirable sharp-cutting filters in printing from the color of the originals. Test data including characteristic curves, filter factors, and spectral sensitivity are presented.

SHOWMANSHIP SIDE OF THEATRE TELEVISION

By *Ralph B. Austrian*
RKO Television Corporation

A discussion of the possibilities of theatre television strictly from the box-office viewpoint. A compilation of the many events which would make good box office fare. A description of many new uses theatre television may be put to which would attract people to the theatre. How theatre television may supplement the present motion pitcure program. A positive viewpoint on theatre television as a legitimate and necessary adjunct to the motion picture theatre.

STUDIO PRODUCTION WITH TWO-COLOR BI-PACK MOTION PICTURE FILM

By *John A. Boyle* and *Benjamin Berg*
Hal Roach Studios, Culver City, Calif.

The increased use of color in motion pictures has brought about a revival of interest in two color bi-pack processes. With proper handling, allowing sufficient production time and good coordination between camera, makeup, art and wardrobe departments, the results with a two-color process

are very adequate. The entire production program of Hal Roach Studios is in a 2-color process, thus the studio technical departments have had the advantage of planning for the limitations of such a process. This has enabled the studio to obtain the ultimate possible from such a process.

A decided advantage for the cameraman has been the use of hard light and exterior type bi-pack film. This has not previously been a general practice because of budget limitations. Lighting techniques, makeup, set-decorations wardrobe, camera and laboratory practices are dealt with.

FILM PROJECTORS FOR TELEVISION

By *Ralph V. Little, Jr.*
RCA Victor Division, Camden, N. J.

Television will make wide use of 35- and 16-mm motion picture film. The method of televising motion pictures using the storage type pick-up device is described. Theatre and television projection practice are compared and methods of meeting proposed RMA television standards are discussed. Recently designed 16- and 35-mm RCA television projectors are described in detail and shown in accompanying slides.

HIGH-EFFICIENCY SPOT PROJECTOR FOR A MR-170 ARC

By Engineering Dept., Paramount Studios

The principles of the *f*/2 high-efficiency optical relay system used on transparency projectors have been applied to a MR-170 arc for spot projection work on production shooting. The high-intensity light can be changed from spot to flood and various sized irises are available for precise control of the spot diameter.

ELECTRONIC FIRE AND GASLIGHT EFFECT

By *Harold Ney*
Warner Brothers Studios

A method is described for electronically modulating small incandescent light sources to simulate the effect of gas flame flicker and light emanating from a fireplace. The effect produced is more natural than can be obtained with dimmer and flasher methods and is entirely automatic.

Oldest Strong Changeover Survey Winners Named

PADUCAH, Kentucky, now has another claim to fame other than the fact that it is the fountainhead of all knowledge relative to the merits of Bourbon whiskey and also is the birthplace of Irvin S. Cobb. Because Arthur L. Melton, an I. A. guy who presides over the projection room of the Columbia Theatre in that town is $100 richer in the form of a Victory Bond and his theatre has 2 new Zipper Changeovers—for free.

This stuff eventuated because Larry Strong, a Local 110 mug and president of Essannay Electric Mfg. Co. in Chicago, thunk up the idea of uncovering the oldest operating Strong changeovers in North America and awarding suitably the custodian thereof.

Colonel Melton, I. A. Local 281, and the Columbia Theatre grabbed off the gravy for dear old Paducah, suh, by certifying the installation in 1928 of a pair of Strong changeovers which, except for 60 days during the 1937 flood (of water, that is, *not* Bourbon) were operated constantly ever since 10 hours a day, 7 days a week. These changeovers, it is conservatively estimated, operated more than 70,000 projection hours *without a breakdown.*

Arthur L. Melton and his projection room at the Columbia Theatre, Paducah, Ky., where award-winning Strong Changeovers operated more than 70,000 hours without a breakdown.

Honorable mention and suitable supplemental awards (the result of intensive picketing of Larry Strong's home and the Essannay plant and ceaseless 'phone calls through a month of nights) were pried loose for the following:

Gerhard Hanson, Princess Theater, Eagle Grove, Iowa, who reports 50,000 hours of operation for a pair of Strong changeovers purchased in 1929; chief projectionist James Boschetti, I. A. Local 596, Greenfield, Mass., who reports 46,720 hours of trouble-free operation in the York Theater, Athol, Mass.; George W. Buss, Local 203, Easton, Pa., who reports using Strong changeovers for 17 years, and Ray Brian, Local 434, Palace Theater, Peoria, Illinois, who says his Strong changeovers have given "17 years of service without a hitch."

IN THE SPOTLIGHT

(*Continued from page 19*)

taxicab business which they recently sold at a handsome profit, and are about to attain the goal for which they strived so many years—owning their own motion picture theatre. Here's wishing them luck.

● Jim Whitebone, secretary and business agent of St. John, N. B. Local 440, fully recovered from a recent operation, attended the convention of the Canadian Trades and Labor Congress.

● Score another for Gene Atkinson, business manager for Chicago Local 110! He recently signed a contract for a 16-mm projectionist to travel from Chicago to Edmonton, Canada, for a period of two weeks at $195 per week, plus $100 for traveling expenses. He also arranged for the Edmonton local to place one of its members on the job to assist in running the show, for which he received not less than $18.60 per day.

Just to prove that he was not just talking through his hat when he warned the Chicago exhibitors to install proper sanitation and ventilation in their projection rooms, Atkinson insisted upon a procrastinating exhibitor paying a penalty of 50¢ for each hour the theatre was open until the installations were made, at which time the penalty would be removed. We don't think Mr. Exhibitor will procrastinate very long.

● Our condolences to Al Florack, member of Rochester Local 253, on the untimely death of his son, Judson. Young Florack, just 21 and recently discharged from the army after three years service overseas, was killed in a motorcycle accident.

● Vancouver Local 348 voted down the proposed opening of theatres on Sundays.

● Lester B. Isaac, supervisor of projection and sound for Loew's, Inc., is a member of the producing committee for the famous "Night of Stars" annual show which will be held at Madison Square Garden in New York City on November 12.

● We trust that Bill Hartnett, business agent for Local 257, Ottawa, Canada, is well on the road to recovery from his recent illness. Bill was stricken shortly after his return from the I.A. Convention in Chicago and had to spend quite some time in the hospital.

● An officer of the Bank of America released a statement to the press in which he said that the film business in this country was 25% ahead of last year, and that the outlook for the next few months was just as bright. So nice to know that.

● A new code for motion picture theatres is being formulated by New York City License Commissioner Ben Fielding. We understand that it provides for the installation of sanitary facilities in every projection room. We shall see.

'Real' Wages Decline

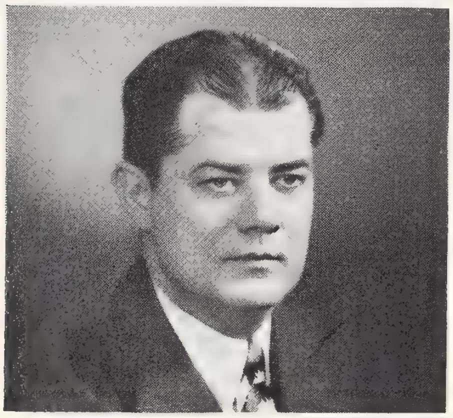
"Real" weekly earnings, or the amount of goods and services that can be bought with weekly pay, dropped 4.8 per cent during July and have declined 9.3 per cent in the last twelve months, according to a monthly survey of twenty-five manufacturing industries by the National Industrial Conference Board, it was announced recently.

Hourly earnings in July advanced 0.3 per cent from June to an average of $1.193, which was 7.9 per cent higher than July, 1945, the board found. Weekly earnings in July averaged $47.58, an increase of 0.8 per cent from June but 2.9 per cent less than in July, 1945.

K. Streuber Expands Movie Lines of New Export House

Karl Streuber, formerly export manager for National Theatre Supply Co. and manager of the Theatre and Sound Equipment Department for RCA International Division, is now squared away for full-tilt operation of his own equipment export house under the name of K. Streuber at 1140 Broadway, New York City 1, N. Y.

Streuber will operate on the "unified service" principle because, as he puts it, "in many years of theatre equipment sales I've become convinced of a real need for expert



counsel as well as sales, since the right product in the wrong place is as unsatisfactory as the wrong product to begin with."

The inclusive Streuber line includes projectors, soundheads, p.a. systems, power conversion units, lobby and marquee accessories, carillons, and complete maintenance parts. A feature of the line is an architectural service which, starting from scratch, will design and equip a complete theatre.

The Streuber sound system is licensed under Western Electric patents.

W. E. Common Stock Dividend

Western Electric Co. on Sept. 30 paid a dividend of 50 cents per share on its common stock to stockholders of record on Sept. 23.

PERSONNEL

Robert H. Hunt has been named sales manager for RCA 16-mm equipment in 12 mid-West states, with headquarters at 663 N. Lake Shore Drive. He replaces *H. E. Erickson*, who has been promoted to assistant manager of the education and sales department at the Camden office. *Elmer H. Beneke* has been named regional sales manager for the Atlanta area, replacing *M. N. Heidenreich*, who has been transferred to the Dallas office in the same capacity.

• • •

Frederick B. Sackett has been appointed manager of the Defender plant of the Du Pont Photo Products department in Rochester, N. Y., succeeding *L. Dudley Field*, who will become the department's adviser on paper products.

• • •

Clarence G. Stoll, president of Western Electric Co., and *Oliver E. Buckley*, president of Bell Telephone Labs., have received the nation's highest civilian award, the Medal of Merit.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933, Of INTERNATIONAL PROJECTIONIST, published monthly at New York, N. Y., for October 1, 1946.

State of New York }
County of New York } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared R. A. Entracht, who, having been duly sworn according to law, deposes and says that she is the Business Manager of INTERNATIONAL PROJECTIONIST and that the following is, to the best of her knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, International Projectionist Pub. Co., Inc., 19 West 44 Street, New York 18, N. Y.

Editor, Henry B. Sellwood, 19 West 44 Street, New York 18, N. Y.

Managing Editor, None.

Business Manager, R. A. Entracht, 19 West 44 Street, New York 18, N. Y.

2. That the owner is:

International Projectionist Pub. Co., Inc., 19 West 44 Street, New York 18, N. Y.

R. A. Entracht, 19 West 44 Street, New York 18, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

R. A. Entracht, Business Manager

Sworn to and subscribed before me this 30th day of September, 1946.

(Seal) BERNARD SCHWARZ

Notary Public, New York County Clerk's No. 185,

New York County Register's No. 196-S-7.

My commission expires March 30, 1947.

THE TECHNICOLOR CAMERAMAN

(*Continued from page* 22)

due to many reasons. Sometimes a reduction of the three-minute threading time is desirable, and when sound shooting is involved and a certain emotional tempo or mood has been established with the principals, unnecessary mechanical interruptions are highly undesirable.

Frequently the director requires two cameras on a shot, and the fact that the supply of extra cameras is often many miles from the stage has an important bearing upon the desirability of this extra camera. The additional cost of the extra camera is a very minor item and the camera usually saves much more than its cost by the saving of production time.

This equipment has been in service for many years, and has successfully met the test of almost all climates, altitudes, and conditions. The cameras have been in all parts of the world—into the crater of Mt. Vesuvius, under the sea near Nassau, almost 20,000 feet above the Andes in South America, in tropical climates, and in subzero temperatures.

Routine studio Technicolor photography has long since passed the experimental stage. It is now handled with the same efficiency and dispatch as many black-and-white units. The negative is developed at night and the negative reports, negative clippings, and estimated printer points are delivered to the Technicolor cameraman on the set the following morning. Black-and-white rush prints, if ordered, are generally delivered the following afternoon, and the color rush prints are delivered the following evening.

The negative reports and all laboratory contacts are handled for the cameraman through the camera department, which also checks the daily log sheets, and by these log sheets keeps a very complete record of every production and of every scene photographed on that production. The records have proved invaluable, not only to the cameraman, but on many occasions to the director and others participating in the production. This most excellent coördinating agency is extremely valuable.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NOVEMBER 1946

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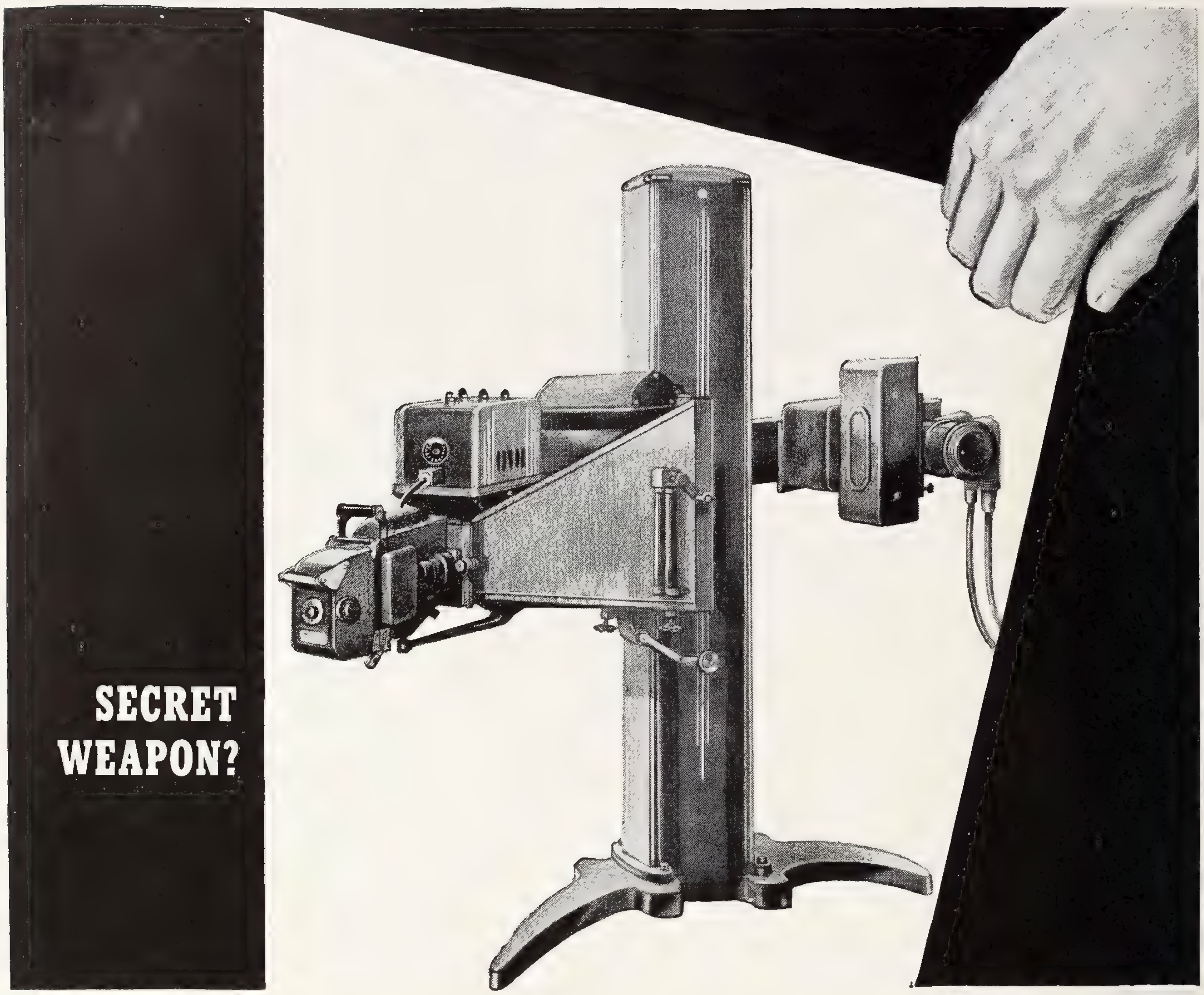

Here's one "secret weapon" that needs to be unveiled in every corner of the land...

THE ENEMY: Tuberculosis, the dread White Plague which kills more Americans between 15 and 35 than any other disease.

THE WEAPON: The X-ray, surest means of catching TB early, when it can be cured more easily and before it spreads.

Christmas Seal money fights TB in many ways; one of the most important is to buy X-ray units and promote mass examinations. Please, send in your contribution today.

BUY CHRISTMAS SEALS

Because of the importance of the above message, this space has been contributed by **INTERNATIONAL PROJECTIONIST**

INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

HENRY B. SELLWOOD, *Editor*

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MONTHLY CHAT

THE combination of visual-sound reproducing equipment and the expert craftsmanship of the projectionist, totalling the art of projection, is as remote from those whom it serves daily as is Hitler from Heaven. Not infrequently projectionists have occasion to regret the general public's lack of knowledge of the intricacies and importance of their craftsmanship, and usually such regret is most acutely felt when the craft has most need of it.

The public relations job done by the craft rarely exceeds the limits established by the sheer necessity for proving, usually at a crucial moment, that its members are neither loafers, nor hoodlums nor irresponsible unionists who are out to "milk" the sensitively-adjusted entertainment business.

This train of thought was induced by our viewing again, after a lapse of six years, the magnificent Disney opus *Fantasia.* Midway in this offering light is thrown, literally, on the gyrations of the film sound track—its positioning, dimensions, and its response variations to the sounds produced by different musical instruments ranging from the highest to the lowest freqnency. Done in gorgeous color, this short sequence made a tremendous impression upon the audience, as was attested to by the startled exclamations of numerous patrons and by the excited questions propounded subsequently by the non-industry people.

Here within the space of a few minutes was accomplished the best public relations job ever done on behalf of the theatre, the projectionist craft and the equipment manufacturers.

Now along comes National Theatre Supply Co. with the suggestion that when new equipment is installed the service company arrange to run at the premier performance thereof a special test reel showing the various requirements which must be met by both the projectionists and the equipment in order to put on a good show.

This is a swell idea—but we'll go them one better. To such a reel why not add a short clip, preferably in color *ala* the *Fantasia* method, which would detail the right and the wrong methods of reproduction, even to the point of deliberately introducing therein examples of deficiencies in the recording, the lighting and steadiness of the picture image, and the sound reproduction. Such a presentation, if accompanied by an informative commentary, could be both entertaining and instructive.

Either of the service companies could easily produce such a reel, and it shouldn't be difficult to stimulate widespread interest and joint cooperation therein by all parties who would benefit thereby — manufacturers, supply dealers, exhibitors and the craft.

This is a grand promotion stunt for the entire industry — *on a community basis, where it counts most.*

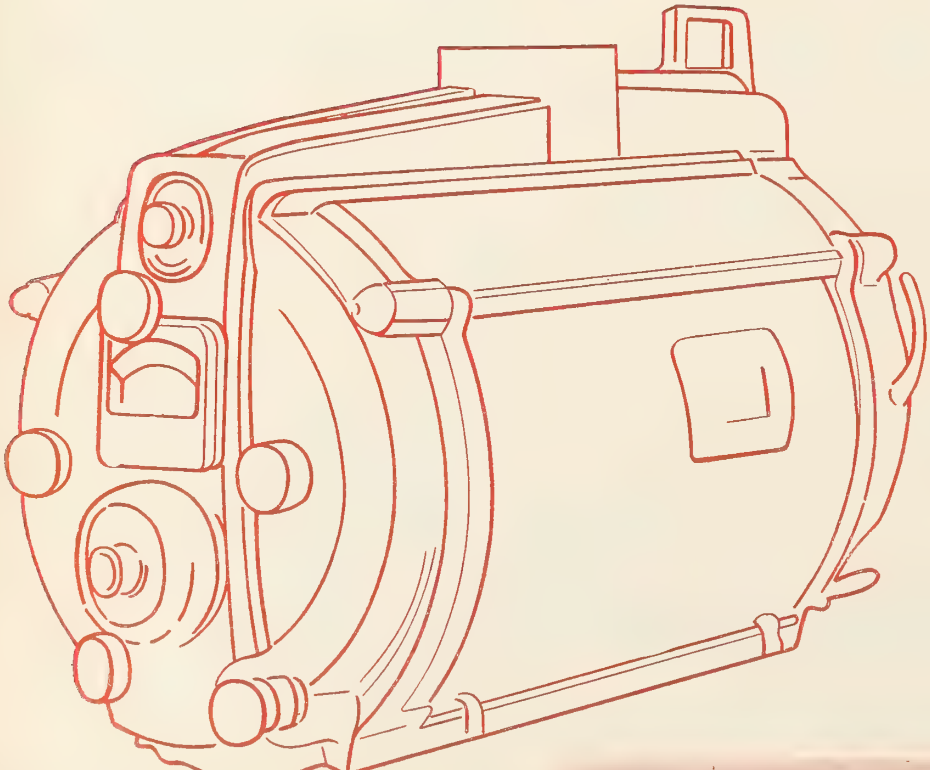
NOW CELEBRATING OUR 20TH YEAR

Make Your Pictures Twice As Bright!

Simplex HIGH

PROJECTION ARC LAMPS

Project the snow-white light so essential to satisfactory projection of Technicolor. Low intensity light is yellow by comparison and changes the color values.



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"There's a Branch Near You

INTERNATIONAL PROJECTIONIST

VOLUME XXI NOVEMBER 1946 NUMBER 11

Notice to I. P. Subscribers . . .

Due to circumstances arising from the combination of an extreme scarcity of paper and the recent transportation difficulties in the Metropolitan New York area, publication of this issue of I. P. has been unavoidably delayed. Present indications are that future issues will adhere to our regular publication schedule.

Electronic Aspects of Sound Systems

By H. W. HASTINGS-HODGKINS

Hastings-Hodgkins, Ltd., London

One of the most interesting papers offered at the recent technical symposium conducted by the British Kinematograph Society was the accompanying step-by-step summary of electronic aspects of sound reproduction. The form of this presentation will serve well all practitioners in the art, irrespective of term of service.

THIS is a summary of the technique of combining electronic devices, such as a photo-electric cell and a valve (amplifying tube) with other circuit elements so that very small electric pulses, created by the passage of a sound track between a source of light and a p.e.c., can be amplified and used to reproduce sound. Fig. 1 represents the simplest electronic circuit of all, consisting as it does of a p.e.c. (A) with an anode and cathode only, connected to a source of direct current (B). The circuit is what is known as a "static" condition, that is to say, nothing much is happening, but there is a positive potential at the anode If, now, we allow light to strike

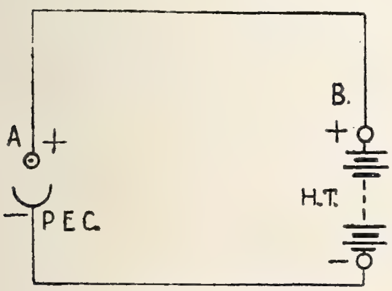


FIGURE 1. Basic electronic circuit, comprising photo-electric cell and H. T. battery.

the cathode, electrons will be knocked out of it and will be attracted to the anode.

Current will now flow in the circuit and the amount of current flowing will vary as the light is varied. We all know our Ohm's law, so we know that to have more current we must have either more voltage or less resistance; the voltage is fixed on the cell, so it follows that the effect of light on the p.e.c. is to vary its effective resistance.

Variation in Current

To do anything with this variation in current, however, it must be passed along to the amplifier in some form. Now, the only acceptable form is as a varying voltage rather than as varying current. However, the voltage of the present circuit will be fixed by that of the battery and something further is needed to enable the varying current to appear as a varying voltage.

This is done by completing the circuit and adding what is known as a "load" (C in Fig. 2). The potential of the battery or source h.t. is applied to the p.e.c. through this load resistance, and any variations in current caused by the action of light on the p.e.c. pass also through the load.

The circuit may now be seen as one fixed and one variable resistance across a source of direct current and. the potential of this source being fixed, more or less of the h. t. voltage will appear across the load resistance as the effective internal resistance of the p.e.c. is changed by the fluctuating light.

If the intensity of the light is alternating, as it would be with an interposed sound track, we get an alternating voltage across the load resistance. This alternating voltage is an easy thing to pass along to the next stage, since we know that a

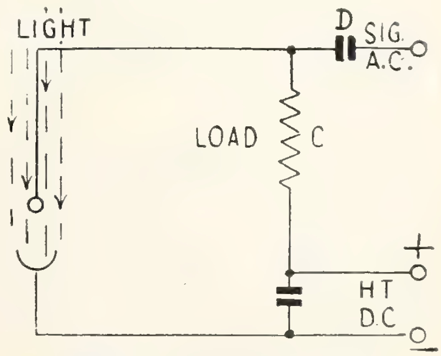
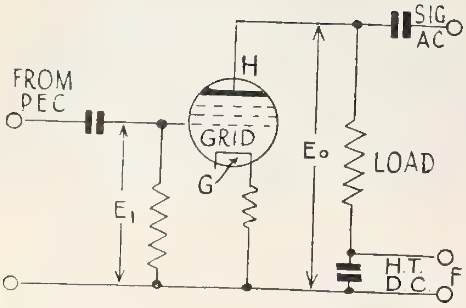


FIGURE 2. Photo-electric circuit.

condenser will provide a ready path for an alternating voltage but not for a direct current. We can, therefore, pass along our signal voltage to the next stage by means of the condenser shown (D),



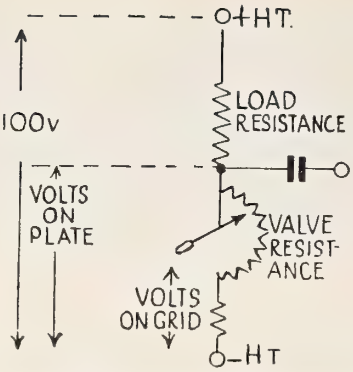


FIG. 3 (left). Circuit of first-stage amplifier. FIG. 4 (right). Electro-mechanical equivalent of Fig. 3.

whilst holding back the h. t. potential from the grid circuit of the following valve.

First Stage of the Amplifier

In Fig. 3 we have the first stage of the amplifier. The circuit is more complicated than that of the p.e.c., but it has many features in common. Again, there is the source of direct current (F), there is a cathode emitting electrons (G), and an anode collecting them (H). There is in the static state a steady direct current flowing out of the h. t. source (F) into the cathode, through the various grids of the valve to the anode (H) and down through the load resistance back to the h. t. source.

Instead of a source of light to vary the flow, however, we now have a voltage available which, as you will remember, we passed on from the p.e.c. via the coupling condenser. With the connections as shown, this alternating signal voltage, E_1, is across the grid-loading resistor and also appears as a varying potential between the grid and the cathode of the valve.

We know how the grid of the valve can be caused to control the electronic current flowing through it. In a static state the grid is held negative to the cathode by the voltage drop across the cathode resistor. In the dynamic state, that is, when a signal is being fed into the circuit, the grid becomes more or less negative with respect to the cathode by the addition to or subtraction from the steady bias voltage of the alternating signal voltage.

In Fig. 4 the operation of the valve and load resistor, with an alternating signal voltage on the grid, may be understood if we imagine the valve to be a variable resistance, the movable arm of which is under the control of the signal voltage. As the grid volts rise and fall, so does the internal resistance of the valve fall and rise. In the same circuit we have the large plate load resistance and the smaller cathode resistance, and the whole arrangement is across a fixed voltage. We may, for example, take this fixed voltage as being 100.

If we ignore the small cathode resistance and assume that the load resistance and the valve resistance are equal when the grid bias voltage is at about five volts, 50 volts of h. t. will be across the load resistance and 50 volts across the valve. If, now, a signal voltage arrives on the grid and this voltage by, say, about one volt is a positive one—that is, makes the grid one volt less negative than it was before—this will have the effect of reducing the valve resistance.

It may now be that 60 volts of the h. t. supply appears across the load resistance and 40 across the valve and we have amplified our *one volt* change on the grid to a *10-volt* change across the load resistance, i.e., *we have secured a "gain" of 10-1 in volts.* This pulse is, of course, passed along to the next stage by the coupling condenser.

From this it will also be seen that the valve is generating nothing in itself but merely causes the h. t. source to release a pulse of h. t. power. The valve, in fact, as an r. c. amplifier, is a control device so arranged to modify the output from a source of power—the h. t. supply—so that small voltage changes are reproduced as larger voltage changes.

In Fig. 5 we have the p.e.c. and first stage of amplification. We will try to trace out what happens, for instance, when the light on the p.e.c. is being reduced by a dark portion of the sound track representing a negative half-cycle of a pure tone. As less light is falling on the cathode, the resistance of the p.e.c. will be rising. One side of the coupling condenser is becoming more positive and the other more negative. The grid of the valve is, thus, becoming more negative and the resistance of the valve is also rising. More of the h. t. voltage, therefore, will be across the valve than formerly, and the valve side of the next coupling condenser will also be going more positive, making the grid of the next following stages more negative.

In addition, the original very small voltage change in the p.e.c. circuit has become a voltage change on the grid of the next stage of very much greater magnitude. To give some kind of figures, we might have, say, one hundredth of a volt RMS from the cell and, assuming an efficient h. f. pentode as the first stage valve, we might obtain as much as one volt RMS at the output side of this stage.

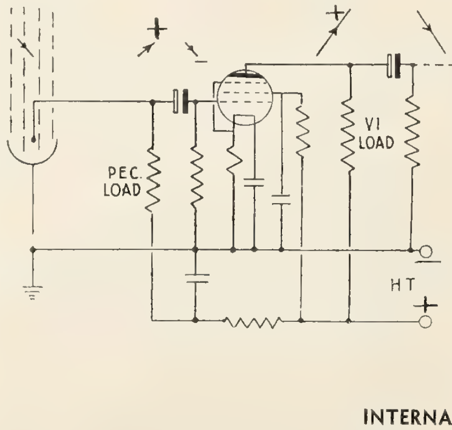
In a practical amplifier, further amplification would be added to raise this to 20 volts or so before introducing phase-splitting and a push-pull stage. The use of a phase-splitter is essential in order to drive a pair of valves in push-pull, since each valve of the pair must have a signal 180 degrees out of phase with its partner.

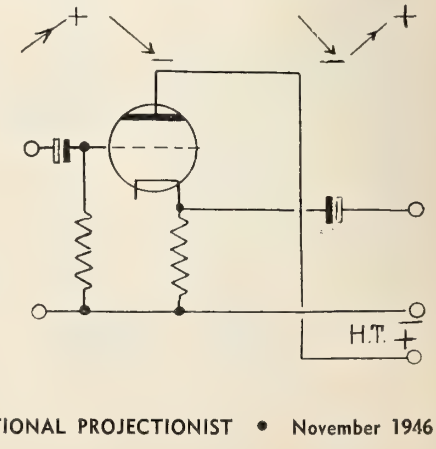
The Cathode Follower

In order to understand the phase-splitter it might be as well first to examine the valve stage known as a "cathode follower" (Fig. 6). We have heard a lot about this recently, but basically it is a very simple arrangement. In normal r. c. amplifiers, we have shown how the load is mainly in the plate circuit with a small part in the cathode lead to provide bias.

In the case of the "follower," however, all the load is between cathode and earth. We get no amplification from such an arrangement because the signal voltages developed across the load never quite equal the signal voltages between grid and earth. We do get, however, an effect known as "negative feed-back" which has advantages under certain conditions, and, in addition, we get the effect from which the "follower" derives its name, that is, that the voltage changes across the cathode load "follow" those across the grid load. That is to say, when, under

FIG. 5 (left). Photo-electric cell and first-stage amplifier. FIG. 6 (right). Cathode-follower circuit.





dynamic conditions, the signal voltage is falling on the grid, it is also falling on the cathode.

This is the opposite rule to that with a normal plate load, for, as we have already seen in that case, a falling voltage on the grid gives rise to an increasing voltage on the plate.

Combining Two Ideas

Now, if we combine these two arrangements in the one circuit (Fig. 7) we have a means for obtaining both a rising and a falling voltage from the output coupling condensers at the same time. If the cathode load and the plate load are of equal resistance, we have available two output signal voltages of the same magnitude but opposite in the sense that one is becoming more positive while the other is becoming more negative—i.e., they are of equal amplitude but 180 degrees out of phase.

It is also possible to obtain this effect by the use of a transformer with a center-tapped secondary, etc., but this technique is left out of the discussion, partly because a transformer is not an "electronic" device and also because many modern amplifiers have electronic phase-splitters and the system has much to recommend it.

So far, we have considered amplification on what might be called a "voltage" basis. That is, the various stages have not been called upon to produce any power but merely to pass on an ever increasing signal voltage into the grids of following stages which, since they can be considered as being of very high impedence, consume an infinitesimal amount in actual watts. The next step is to cause this much amplified signal voltage, which we obtained in the first place from our p.e.c., to release enough power from the h. t. supply to work the loudspeakers.

Push-Pull Operation

One of the most efficient ways of doing this is to combine two "power" valves in the circuit arrangement usually known as push-pull (Fig. 8). This is quite a descriptive term, for we can conceive that as the signal voltages are being fed to the two grids at 180 degrees out of phase, one of the pair can be imagined as "pulling" over any half-cycle and the other as "pushing." This is substantially true of the type of push-pull known as class "A"; but in the more general class "AB" push-pull, the grid bias voltage is increased to a point where, during each half-cycle, the signal is partially suppressed or distorted in one valve whilst having a full swing in the other. In any other connection but push-pull this would lead to unpleasant distortion, due to the generation of a second harmonic.

Not so in push-pull, however, because this second harmonic is canceled out in the common primary of the output transformer. In plain English, we are able seriously to overload the valves, obtaining from them more than twice the normal output of one valve, without paying for this in distortion.

As was explained, we are now concerned with the job of turning signal volts into output power. The valves used have a generous emission, pass a lot of current and are designed for a high voltage. In class A and "ABI" push-pull the grids consume very little more power than those of the r. c. stages, thus we have the picture of very nearly wattless grid voltage releasing upwards of 30 watts or more in signal power from the h. t. supply across the primary of the output transformer, to be conveyed therefrom to the loudspeakers.

We have mentioned harmonic distortion, and a few words as to how this is liable to be generated in a valve may be useful (Fig. 9).

If a valve were a perfect linear device, i.e., if the relationship between grid

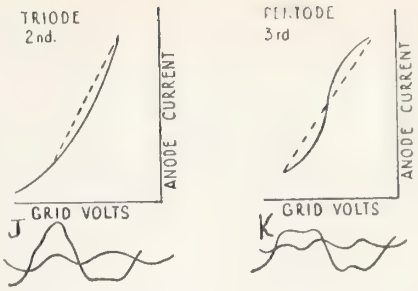


FIGURE 9. Distortion in triode and pentode.

volts and plate current were a straight line, harmonic distortion would not trouble us. Unfortunately, this is not so, and instead of a straight line we have a curve of some sort. On the working part of a triode characteristic this is a bow-shaped curve and this always produces a certain amount of second harmonic which, as will be seen, is a simple doubling of the pure tone (J).

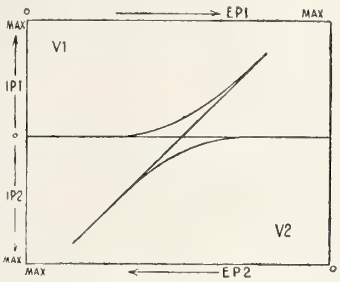
The two wave-forms in combination show that one half-cycle is peaked, whilst the other is truncated, and we can realize that when this second harmonic is canceled out, as it is with push-pull, the wave-form is restored to normal. The pentode valve, on the other hand, has more of a snake-like curve and this will produce a third harmonic, i.e., three times the fundamental. Both half-cycles are now truncated (K).

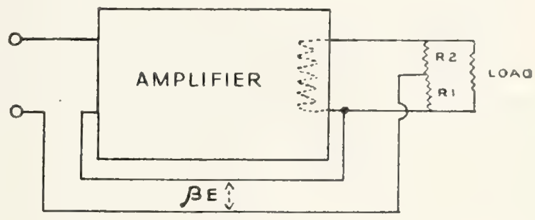
We must face the fact that a push-pull arrangement will not help very much with this form of distortion. On the other hand, it may be much reduced by the use of negative feed-back and the percentage present is not high with proper design.

Figure 10 shows the combined characteristics of a pair of valves in push-pull. These are anode current-anode voltage curves placed back to back, and it can be seen how, as one characteristic curves away from the straight, it is compensated for by the other which is coming into the straight. The perfectly straight center line is supposed to indicate the combined effect of the two valves across the output transformer.

Negative Feed-Back

Figure 11 is a block diagram of an amplifier with external connections. This is an example of negative voltage feed-

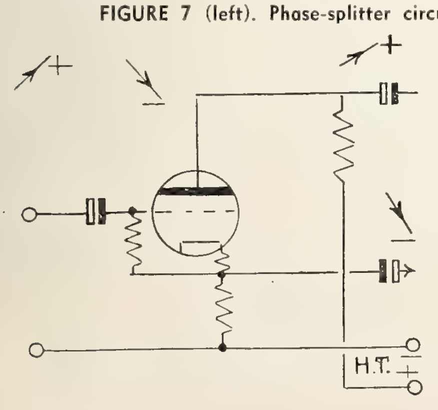


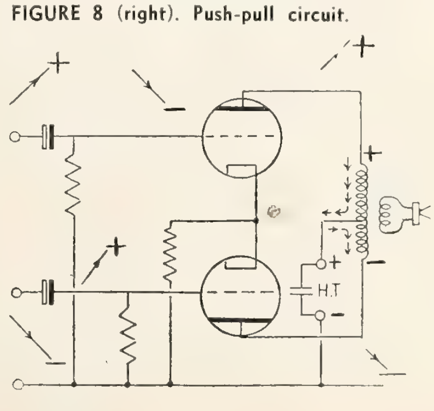


$$\beta = \frac{R1}{R1 + R2}$$

FIGURE 10 (left). Characteristics of valves in push-pull. FIGURE 11 (right). Principle of negative feed-back.

FIGURE 7 (left). Phase-splitter circuit. FIGURE 8 (right). Push-pull circuit.





back, in which a proportion of the output voltage is "fed back" in opposition to the input voltage; obviously this is going to reduce the gain of the amplifier, and it may be asked why we should do this. One of the reasons for using negative feed-back is to improve the overall characteristic curve of the amplifier; it can be realized that if, for instance, we have some "humps" in this curve, we shall also get reverse "humps" fed back which will even things out.

Another advantage of negative voltage feed-back is that it reduces the internal

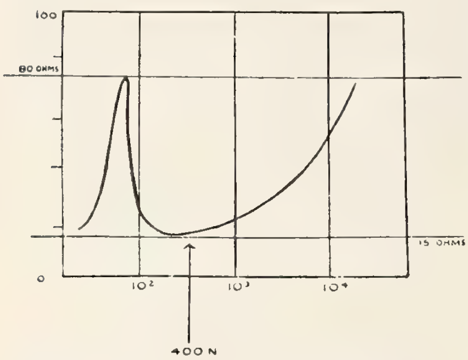


FIGURE 12. Frequency correction by feed-back.

impedance of the amplifier, regarded as a "generator." Now, the internal impedance of a generator can be regarded as being in shunt with the load impedance—in this case, the loudspeakers—and by examining Fig. 12 we shall see another advantage of negative feedback.

This sketch shows the variations in load impedance of a normal moving-coil loudspeaker at various frequencies. At about 90 cycles the load rises steeply, and also at the higher frequencies. It is obvious that this feature would lead to frequency discrimination in the actual sound output of the loudspeaker if the total load on the output stage of the amplifier were not smoothed out in some way.

In Fig. 13 we show the internal impedance of the amplifier with negative feedback and the impedance of the speaker as two resistances in shunt across the output of the amplifier. The internal generator impedance of the amplifier is shown as 30 ohms and the speaker load is shown as varying from 15 to 80 ohms, according to frequency. The curve nearest to the "internal impedance" gives some idea of the shunting effect of the generator load on the speaker load and how the peaks in the speaker load tend to be ironed out. Fig. 14 is intended to give the general picture of feedback, in which some of the voltage arising on the valve anode is fed back to the grid.

DISCUSSION

QUESTION: How many valves can be used in paralleled push-pull?

ANSWER: There is no reason why push-pull stages should not be paralleled, but such paralleling is generally confined to four valves. I do not see why more than this number should not be used, although it seems likely that one will run into design troubles, particularly with regard to instability. It is generally better, when designing a larger output than that available from four 6L6 valves in a parallel push-pull, to select instead a pair of large triodes capable of the extra output.

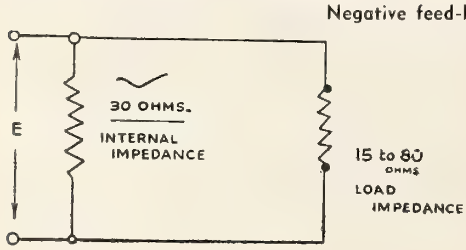
QUESTION: Could you explain how the voltages are equal in a phase-splitter circuit but unequal in a cathode follower circuit?

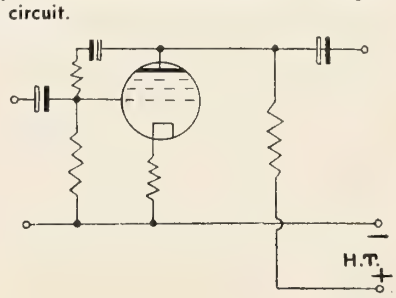
ANSWER: If output voltages are referred to, it is true to say that in the phase-splitter we are deriving two equal and opposite voltages across the two output loads. Each of these voltages is slightly less than the input voltage, in the same way as the output voltages of the cathode follower is slightly less than the input, owing to the heavy feedback.

QUESTION: Please explain how correct bias voltages for valves can be estimated, as the manufacturers do not appear willing in all cases to consider special applications.

ANSWER: Most manufacturers are quite willing to give information covering special applications not covered by the characteristic curves issued, but there are so many factors to be considered that it is impossible to lay down a hard-and-fast rule.

FIGURE 13 (left). Effect of feed-back in correcting speaker characteristics. FIGURE 14 (right). Negative feed-back circuit.





Video and Motion Pictures†

By RICHARD HUBBELL

The second and concluding article by an acknowledged authority on television in which are cited the many similarities between video and motion picture production and exhibition.

THE production methods of television and motion pictures look alike in still photos. Both have cameras, lights, microphones on booms, and both are housed [or should be] in large, flexible stages, the walls of which are covered with acoustically-dead material to absorb sound reflections. A movie camera exposes rolls of celluloid film. The television camera uses no film, except in specialized cases. It is entirely electric,[1] as is the human eye, and it is "seeing" all the time—no need to take time out to change a reel of film. Since television is not a photographic process, it entails none of the bothersome details of handling film, chemical processing, fire precautions, storage conditions, distribution in cans.

For these reasons actual television camerawork can, in one respect, be simpler than in motion pictures. All control of cameras and microphones is accomplished, as in radio, by turning a few knobs or throwing a few switches. By merely pressing a button here and there one can get superimposures (double exposures) and other visual effects which are difficult and costly in film work.

On the other hand, television equipment cannot yet do all visual tricks as perfectly as motion pictures can. For example, on early equipment when one made a video "board fade"—that is, faded out the picture by turning down the camera control or video gain—the picture faded out, but in its place one often saw five or six diagonal white lines across the front of the television screen. Undoubtedly this defect and many other minor ones will be eliminated as television broadcasting goes ahead.

Films' Important Role in Tele

From a practical point of view there are certain very strong points which favor the extensive use of film in the early years of television. Perhaps the strongest of these is the fact that it takes time to build extensive television network facilities so that one program can be broadcast in all parts of the country at one time. Until such facilities are ready in any given area, films offer the

(*Continued on page* 28)

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'RMS'—Its Meaning and Application

By DR. A. N. GOLDSMITH
Consulting Engineer, N. Y. City

THE abbreviation "rms" stands for "root-mean-square". This, in turn, is an abbreviation of the longer phrase: "The square root of the mean, or average, value of the squares of all the values of". This looks like rather a mouthful, but it is really fairly simple, and it covers a necessary way of finding the useful, or effective, value of alternating currents, voltages, or power.

Supposing we want to find out how much heat is produced in a conductor by an electric current. This is important in connection with incandescent lamps, the heat of electric machinery, the power in an electric arc, and similar heating effects of electricity. It is well known that the rate at which power is produced by a given electric current passing through a definite resistance is given by the relation that the power in watts equals the square of the current multiplied by the resistance.

As long as we deal with direct currents of constant value, the problem of heat effect is easy enough. For example, if a direct current of 5 amperes flows through a resistance of 4 ohms, the power absorption, or heating effect, is 5 squared (or 25) multiplied by 4, or 100 watts.

But suppose we deal with a current which is changing. For example, supposing the current starts at zero and increases steadily to 10 amperes, changing by the same amount every second. That is, it rises at a steady rate from zero to 10 amperes. The current has an average value of 5 amperes. At this point it is easy to be fooled and to assume that because the average value of the current in this case is 5 amperes, if such a current flows through a resistance of 4 ohms, it will require an electrical power of 100 watts (as before in the case of the direct current) and will also produce an amount of heat corresponding to 100 watts.

Average Power Calculation

The fallacy of such reasoning is easily shown. When the current is at zero, the power is also zero. When the current has risen to 5 amperes, the power is 100 watts. But when the current has risen to 10 amperes, its greatest value, the power has risen to the square of 10 (or 100) multiplied by 4, or 400 watts. Clearly the average, or mean, power in this case is not 100 watts.

In such cases of constantly changing currents obviously we have to take three steps to find out what the average power is (or what constant current would generate the same amount of power). The three steps are the following:

Step 1. Square the value of each instantaneous current flowing during a given period. We shall call this the "squaring" process. It gives an indication of the instantaneous power required (through 1 ohm).

Step 2. Take the mean, or average, value of all the squared currents obtained in Step 1. This gives us the average, or mean, value of the squared currents or instantaneous powers through 1 ohm.

Step 3. Take the square root of the value of the average square obtained in Step 2. This gives us the square root of the mean, or average, value of all the squared currents (or instantaneous values of power through 1 ohm).

And the result obtained from Step 3 is the quantity we have been seeking which shows what steady current, flowing through 1 ohm (or, indeed, any other resistance) would give the same heating or power effect as the actual changing current which we have considered.

If Step 3 be considered again, it will be seen that the new quantity which would have been calculated in this way is the square root of the mean value of the square of all the instantaneous current values during the period in question. And that is why it is called the "root-mean-square," or "rms" value.

While the foregoing describes the process of getting the "rms" value, the actual calculation is far from simple. It really requires fairly advanced mathematics to determine the rms value of currents or voltages varying in particular ways

A Typical Application

Perhaps the best known example, and one which is of most importance to electricians, is the rms value of a true alternating current of the so-called "sine-wave" type. This is practically ordinary alternating current as obtained from the power mains or ordinary alternaters. In this case, if the alternating current goes from zero value to an instantaneous power of 10 amperes, and then back to zero, and then reverses to a negative peak of 10 amperes, and back to zero and so on, the rms value turns out to be 7.07 amperes.

This leads to two interesting comments. In the first place, any alternating-current ammeter placed in the circuit will read 7.07 amperes in this case, for it will be designed and calibrated to read rms values.

The second point is that the reserval of the alternating current half of the time does not change the heating effect. Heat is produced regardless of direction of flow of current. This is unfortunate, perhaps, because it might be easy otherwise to reverse a heating current and get refrigeration!

SCROLLS OF ACHIEVEMENT IN SOUND PICTURES AWARDED BY SMPE

Receiving their scrolls at the Society's 60th Semi-Annual convention are (left to right): T. K. Stevenson, Western Electric; Earl Sponable, 20th Century-Fox; Douglas Shearer, M-G-M; Donald Hyndman, president of SMPE, who conferred the awards; Max Batsel, RCA; S. E. Gates, General Electric; Dr. Harvey Fletcher, Bell Telephone Labs.; Charles A. Dostal, Westinghouse; and Jack Gaines, accepting for Dr. Lee de Forest.

Three Major Projectors Now Factory-Equipped With Strong 'Zippers'

All new Motiograph AA, Brenkert, and DeVry projectors are now being factory-equipped with Strong "Zipper" changeovers, it has been announced by Larry Strong of Essannay Electric Mfg. Co., Chicago. All requests for changeover data should be addressed to the latter company at 1438 North Clark Street, Chicago 10, Ill.

Incandescent Lamps for Film Projection

By J. J. A. MANDERS

Research Laboratory, Philips Incandescent Lamp Company, Eindhoven, Holland

WHEN in addition to the normal 35-mm film, the narrower film (originally 9½ mm, later 8- and 16-mm also) began to be used, it seemed as first as if not only the field of application but also the projection apparatus for the two types would differ in principle. The main problem in projection technique is that of passing the large light flux, which must be thrown on the screen, through the small film aperture, whose area in the case of 16-mm film is about one-fifth and in that of 8-mm film about one-twentieth of that for normal film.

Narrow film was therefore predestined for use in the home or in small auditoria with a small projection screen, where less light was needed. And while normal film was projected with the help of arc lamps and mirror condenser, the narrow film projector for the small audience worked exclusively with incandescent lamps and lens condensers. Only in that way could they be made sufficiently small and cheap, safe in use, easily transportable and fairly foolproof.

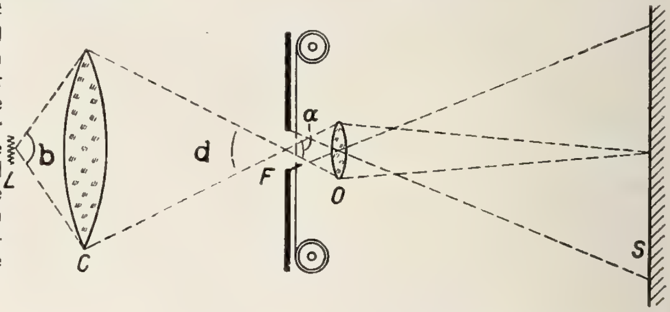
Wide Gains by 16-mm Film

At the present time, however, the former sharp boundary between normal and narrow film projection is becoming vaguer. This is due mainly to the fact that the advantages of the narow film (cheaper installation, lower film costs, possibility of the use of non-inflammable film material) have gained for it more territory which belonged originally only to normal film: the halls and auditoria in which 8- and 16-mm film is shown are growing larger and larger and approaching the size of ordinary motion picture theaters, and *non-portable* apparatus is now being made for that size film.

Another reason for this development was that the noisless and quietly burning incandescent lamp, which was being manufactured for the growing subnormal film projectors in types of steadily increasing power, was displacing other light sources, even in normal film projectors. This was possible to a certain extent in smaller theatres, but not in larger ones where, because of its greater brightness, the arc lamp continues in use. During the last few years before the war the super high-pressure mercury lamp appeared as a new serious rival of motion picture light sources, and the intrusive narrow film has in the meantime also taken possession of this aid in order to win new territory.

In discussing incandescent lamps for film projection we shall not, according to the foregoing, be able to draw any sharp boundary between lamps for normal film — called theatre lamps — and those for narrower film. There is indeed a difference in lifetime: according to universally accepted standards, the lifetime of theatre lamps must be 100 hours; while in the case of narrow film lamps 50, 25 or even only 10 hours is considered sufficient. This difference is, however, based more on tradition than upon logical grounds.

FIGURE 1. The optical system used for film projection. The light from the filament of the lamp *L* is collected over a wide angle by the condenser lens *C* and focussed on or near the film window *F*. The film picture passing *F* is projected by the objective *O* on the screen *S*.



In principle, the requirements for theatre and for narrow-film lamps are the same, and the fact that in practice each type of projection lamp is stated to belong to one or the other category is mainly because generally each type of lamp can be used only in a certain type of projector which will naturally be intended for either normal or narrower film.

Enormous Brilliance Required

In projection the film picture occupying the aperture is thrown on the screen as an enlarged image by the objective [see the right-hand part of Fig. 1]. Now, even if all the light falling on the film reaches the screen, the intensity of illumination of the screen will be more than 60,000 *times as small* as that on the film aperture. If, for example, it is desired to have 50 lux[1] on the screen (75 to 100 lux is usually demanded), the intensity of illumination on the film, taking into account the losses by reflection and absorption in the objective (about 50%), must amount to about 6 million lux!

This enormously intense illumination is obtained by projecting the image of a very bright light source—in our case the filament of the projection lamp—on or near the film aperture by means of a condenser system (see the left-hand part of Fig. 1). As may be seen, the condenser has the function of collecting the light emitted by the source over a very wide angle and concentrating it on the film within a smaller angle. Naturally, if the objective lens is not *entirely filled*, much unused light passes the objective.

In order to obtain maximum illumination on the screen it is desirable to raise the brightness of the light source as high as possible. In addition, the loss factor must be kept as small as possible. In our case the losses at the aperture constitute a large percentage of the whole.

Positioning of Filament

Because the filament of an incandescent lamp is not a uniformly luminous plane, it may not be focused exactly on the aperture. If it were, the structure of that filament image would also be porjected on the screen. The filament is therefore focused farther away, either in the objective or at a spot between the objective and the aperture.

In other words, the aperture is not situated at the narrowest part of the beam of light produced by the condenser, and a larger or smaller part (70%, for example) of this beam is cut off by the edges of the aperture. The more uniform the brightness of the filament, the

Characteristics of the optical systems in which film projection lamps are used demand that the following requirements be met: the filament must have great brightness and must fill a given area as completely as possible, the diameter of the bulb must be small, and the lamp must be adjustable automatically. Herein is explained how these and other requirements are satisfied, with particular emphasis on filament construction and the part played by the gas filling. This is the first of a series of articles which cover comprehensively the topic of film projection lamps and which merit intensive study by professional projectionists.

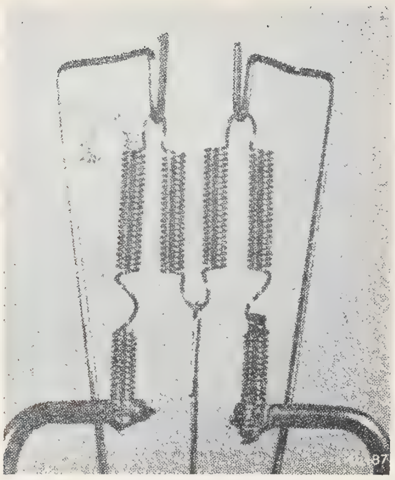


FIGURE 2. Filament of a spiralized wire composed of four parallel sections of spiral.

closer its image may be focused to the aperture and the smaller the light loss at that point. The greatest possible uniformity of brightness of the filament is thus a second requirement.

Further requirements follow from a consideration of the condenser setup. The light from the lamp is obviously used more economically the larger the angle b compared with $d = a$ (see Fig. 1). If it is desired to limit the distance between source of light and aperture to a certain length, in order to prevent the whole projector from becoming too large, a large angle b means that the lamp filament must be placed very close to the condenser, thus that the lamp envelope diameter must be as small as possible.

Furthermore, with given values of b and d a certain enlargement of the filament is obtained. Since the size of the filament image is fixed by the size of the objective to be filled, the minimum size of the filament is also prescribed. In general, it is found that the filament must occupy a rectangle of between 5 and 10 mm width. The filament may be made larger, but there is in the first approximation no profit in that.

With the dimensions the position of the filament is also exactly prescribed. It is therefore desirable in constructing the lamp to take care that in inserting the lamp in the projector the filament automatically occupies the correct position in the optical system.

Finally, the requirement about lifetime. The various accepted times were stated previously herein. Since the lifetime is ordinarily determined by the velocity of evaporation of the filament, the prescription of the lifetime means that the manufacturer must first choose a suitable working temperature. The brightness is also mainly given thereby.

We shall see how the manufacturer, with the limited number of available degrees of freedom (nature and configuration of the incandescent body, gas filling), tries to increase the brightness as much as possible. Also, he must take care that the lamp lives out its natural lifetime and does not succumb too soon to the mechanical vibrations due to the jerking motion of the film transport. He must also take care that the light output does not decrease due to blackening of the envelope or deformations in the small, very rigidly fixed filament.

Construction of the filament: The use of spiralized wire

For the construction of the filament, accordingly, there are three primary requirements: it must cover a certain rectangle of from 5 to 10 mm width, its brightness must be as uniform as possible, and the average brightness as high as possible.

Regarding the first and second requirements, it might be thought that a tungsten ribbon would be the ideal solution, such as is used in the ribbon lamps developed for photometry. A very uniform luminous surface could then be obtained in a simple way. This would, however, be at the expense of the third requirement: compared with the spiralized wire used in electric lamps for the same lifetime the working temperature and consequently the brightness of the ribbon must be chosen considerably lower. This is because the ribbon has a comparatively larger surface for evaporation, while, moreover, the tolerances in thickness in the rolling of ribbon are larger than in the drawing of wire.

The permissible temperature which must be calculated, so that the thinnest spots will not succumb before the desired lifetime is reached, is thus further depressed in the case of the ribbon. Also, in brightness obtained at a given temperature of incandescence the ribbon is inferior to the spiralized wire, due to the fact that with the latter a cerain "black body effect" occurs[2].

Thus, for the sake of the third requirement, great brightness, a spiralized wire is used, and with it the prescribed area is filled as well as possible. For this purpose the spiral is usually divided into a number of sections which are assembled parallel to each other in a vertical plane, for instance as shown in Fig. 2.

The sections of the spiral will preferably be placed as close together as possible. In the first place, the uniformity of brightness of the filament image is thereby improved or, more accurately, its structure becomes finer, so that a slight lack of definition in the image is insufficient to render the structure invisible. The filament image can then be focused at a spot closer to the aperture. In the second place, of course, the average brightness of the filament image becomes larger as non-luminous intermediate spaces between the wires are smaller.

[To be Continued]

[1] An illumination of one lumen per square meter is called a "lux."

[2] Clean bare tungsten has an emission coefficient of about 0.5. With the spiral, part of the radiation is reflected one or more times back and forth between the windings before it reaches the outside, thus the radiation takes on more the character of that from a black body, and the emission coefficient correspondingly approaches more closely the value of unity.

Dr. Wilbur A. Rayton Dies

Dr. Wilbur A. Rayton, head of the Scientific Bureau of Bausch & Lomb Optical Company and one of the nation's top-ranking optical engineers, died suddenly last month at the age of sixty-three. He attended the S. M. P. E. convention in Hollywood and was in San Francisco on a business trip when he was stricken with a heart attack.

Dr. Wilbur A. Rayton

A member of the optical firm since 1908, Dr. Rayton was appointed head of the Scientific Bureau in 1926. Only two months ago he received the Navy Ordnance Development Award for "distinguished service to research and development of gunfire control equipment" during World War II.

He was born in Rochester and attended Brockport Normal and Livonia High Schools before entering Syracuse University in 1901. Upon graduating from Syracuse in 1905 with an A. B. degree, he taught physics at Wheeling, W. Va., and Dansville, N. Y. high schools before joining Bausch & Lomb. As a member of the Scientific Bureau he was actively engaged in the development of photographic lenses, rangefinders, heightfinders, binoculars and other optical devices used by the Army and Navy during both world wars.

Awarded Honorary Degrees

Dr. Rayton was awarded an honorary degree of doctor of science by the University of Rochester in 1933, and in 1942 the same honor was bestowed upon him by Syracuse University. He was widely known in national scientific circles and held membership in the Society of Motion Picture Engineers, Optical Society of America, American Association for the Advancement of Science, American Cinematographers, Photographic Society, and the American Society of Photogrammetry.

Surviving him are his wife, Elizabeth W. Rayton; a son, Willis McNair Rayton, a physics instructor at Dartmouth College, and a daughter, Mrs. Richard Halliburton, Hollywood, Calif.

TELECASTS

Unsolved Problems Litter Tele Confab

THE notion of television "just around the corner" was quite effectively dispelled, in the opinion of impartial observers, by the proceedings at the Second Television Conference and Exhibition held recently at the Waldorf Astoria Hotel in New York City under the auspices of the Television Broadcasters Association, Inc. Ballyhooed as the event which would signalize "television arrived," the Conference served only to emphasize the uncertainty, if not actual pessimism, hovering over the councils of protagonists of this baby art.

Only the technicians among video practitioners evidence any degree of self-assurance, as was amply illustrated by the demeanor of the engineers at the Conference, whose attitude was more than justified by reason of the mighty strides forward scored by this group in the past year. But this assurance definitely was not shared by the commercial video group.

Commercial tele's greatest headache is the two-headed problem relating to the need for providing at least a 30-hour weekly schedule of telecasts plus the quick sale of several hundred thousand home receivers. This problem, simply expressed, involves a greater expenditure of money for programming by advertisers who are understandably reluctant to pay such a heavy dollar-per-viewer cost.

Set Sales vs More Programs

"Sell thousands of sets more to justify our advertising expenditures," demand the potential program sponsors. To which the set manufacturers and broadcast stations reply: "We can't sell sets until the purchaser is convinced that he will get his money's worth in terms of entertaining programs."

No promise of a speedy penetration of this vicious circle was forthcoming at the sessions, not even from the panel discussions by 80 "experts" in various phases of the art, nor from the utterances of the self-assured technicians, and certainly not from the exhibition of new home receiver sets by eight manufacturers.

The exhibition of receiver sets strengthened the suspicion that home-television will be confined for quite some time to the so-called "class" audience. Prices of the sets displayed ranged from $225 to $2,640; but it is seriously to be doubted if these prices can be maintained under existing inflationary tendencies. It will evidently require an abundance of entertaining telecasts on a week-in-and-week-out schedule, much as radio offers at present, to occasion any set-buyers' stampede. Thus the dilemma.

The well-worn topic of theatre television was once more the subject of extended optimistic comment by its proponents, but not even this extravagantly enthusiastic handling of the topic promised anything more than what is in effect a retarded newsreel—the time lag still being dependent upon requisites of other portions of the theatre program and ranging from one to twenty-four hours.

Extensive Film Use Forecast

There was unanimity of Conference opinion as to the vital role film will play in the video art, both for spot news and for ambitious dramatic productions; but this eventuality can be of prime interest only to the manufacturers of film stock and to the production forces, as contrasted with the exclusion from consideration of the interests of the exhibition field as presently constituted.

Nobody at the Conference even attempted to explain why the owner of a tele receiver should stretch a shoelace to leave the comparative greater comfort and convenience of his own living room to hustle down to the neighborhood Vogue Theatre to view a film program.

It is a well-known fact that a television presentation induces within the auditor-viewer a feeling of restlessness engendered by a sub-conscious conflict for the lion's share of interest. This feeling is often experienced when viewing a sound motion picture, with the spectator's interest being focused first on the dialogue and then on the visual aspects of the presentation. Television demands the closest attention and concentration for a comparatively small area of space on the part of the viewer. With radio programs, however, one is accorded complete freedom of movement within a certain well-defined area.

Emphatic silence was accorded these and other psychological problems of video by those who, professing to have studied the requirements of television, exploited their "expert" status to disseminate only such information as has long been a commonplace of the art.

Excessive Ballyhoo Decried

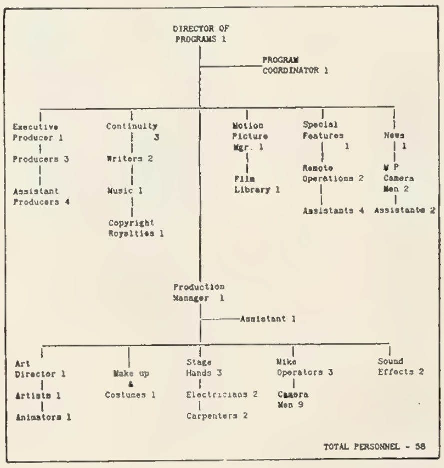
Summed up, the Conference impressed outside observers as having served only to further confuse the situation. Apparent on every hand was the feeling that television had been over-exploited and that the general public's interests had been worn paper-thin by the iteration and reiteration of miracle achievements "just around the corner." Significant in this respect was the comment by Edgar Koback, president of Mutual Broadcasting System, who stated bluntly that television had been "over-publicized" with the inevitable result that "excessive expectations" were held by the public. "What we need most," he continued, "is less talk and more application of what we have learned in the past."

One definitely cheering note was sounded by representatives of American Telephone & Telegraph Co. who disclosed that 3000 miles of coaxial cable had already been put underground as the nucleus for a nation-wide video transmission belt, with 3000 more miles to be added by the end of 1947. Excerpts from comments on various other aspects of the television art are appended hereto:

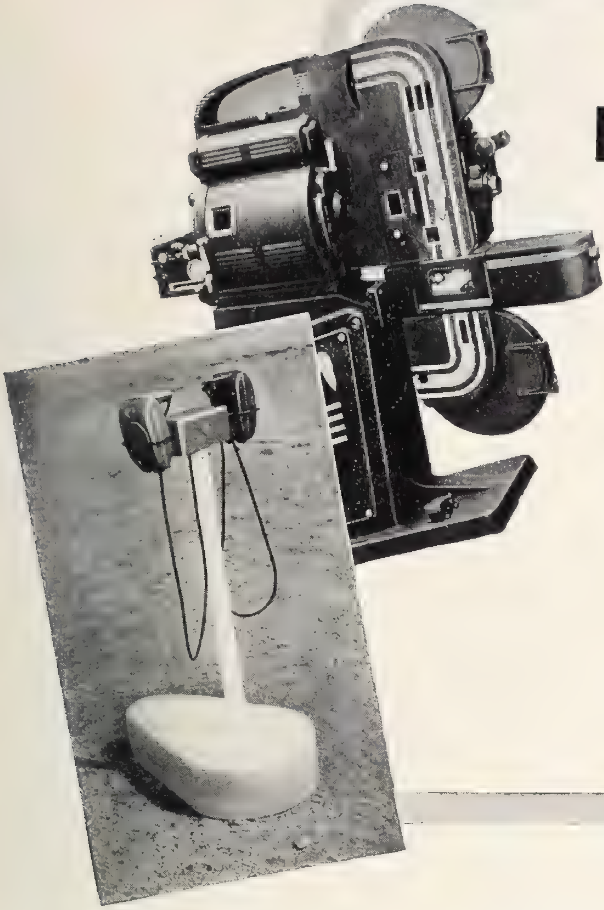
Set Guarantees, Maintenance: Some manufacturers are guaranteeing their sets for a year against possible breakdown. Others are using the 90-day RMA Guarantee for the electronic parts, and a year's guarantee for the cathode-ray tube. The ultimate decision as to which of these procedures will survive is largely a matter of experience and competitive approach, and it is somewhat early to predict them.

The same holds true of the amount of money it will cost the average set-owner to maintain his set in good-working condition

(*Continued on page* 27)



Diagrammatic representation of typical television studio departmental and personnel set-up. Provision for stagehands and other technicians emphasizes omission herein of projectionists, who will inevitably play a major role in video studios.



BRENKERT PROJECTION and RCA SOUND EQUIPMENT... the logical choice for the DRIVE-IN THEATRE

THE ROCK-STEADY projection and increased light on the screen provided by Brenkert Projectors and Brenkert Arc Lamps make them the logical choice for the Drive-In Theatre, where the larger screen—up to 52 feet in width—and longer throw—250 feet and higher—demand top projection efficiency.

Dependable arc-lamp power supplies are also extremely important. RCA offers the well-known Century-Roth Motor Generators, Westinghouse Copper-Oxide and Baldor bulb-type rectifiers because of their outstanding performance.

RCA Drive-In Theatre Sound Systems are not modified conventional systems; they have been specially designed and time-tested for Drive-In Theatre use. Engineered for life-like tone fidelity and minimum distortion, they are built to provide the high powers needed for covering large areas with fixed speakers, or for large numbers of the new type *In-Car Speakers,* which permit operation in cool or rainy weather. Special circuits developed by RCA automatically compensate for speaker load changes—eliminate the need for volume adjustment regardless of the number of speakers in use.

Everything for the Theatre

At your RCA Theatre Supply Dealer

- RCA Sound Systems
- RCA Drive-In Theatre Equipment
- Brenkert Projectors
- Brenkert Enarc Lamps
- Snowhite Screens
- Baldor Rectifiers (Bulb type)
- Westinghouse Copper-Oxide Rectifiers
- Century-Roth Motor Generators
- Mohawk Carpets
- International Chairs
- Westinghouse—
  - Lamps and Fluorescent Lamps
  - Rectigons
- RCA Service Co.
  - Service and Replacement Parts

Free Booklet—Be sure to see the new RCA booklet, "The Drive-In Theatre"—30 pages of important information: How to select locations, points on construction and installation, temperature charts for various sections, and other valuable helps to Drive-In Theatre planning. Write *today* to Theatre Equipment Department 43-K, RCA, Camden, New Jersey, for your copy.

THEATRE EQUIPMENT

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

IN THE SPOTLIGHT

By ***HARRY SHERMAN***

IT IS now almost two years since we reached a victorious conclusion to a long and bitter war and we are still in the process of transition from a wartime to a peacetime economy. This conversion has been attended by many disputes and magnified by various groups for a widespread attack on labor. The barrage of publicity which followed these disputes emphasized the faults of labor, and its enemies have bent their efforts to hamstring and destroy labor's hard-won advances.

The public was brought to believe that the consequences of labor-management disputes could be avoided by placing restrictions on labor. To this end a large number of bills were introduced in Congress limiting the rights of labor. Not once did the sponsors of these bills consider that restrictions on labor constitute an attack on the civil liberties of labor and the civil liberties of all.

Liberty is the keynote of our system and we should not ignore such civil rights as the right to organize, the right to strike and to bargain collectively, and the right to picket. These liberties have been achieved by the enactment and enforcement of the Norris-LaGuardia Anti-Injunction Act and the Wagner Labor Relations Act, as well as by the many decisions rendered by the United States Supreme Court. Although labor has had these "rights" for the past 15 years only, it must ever be on guard to protect and preserve them, especially against legislation which would nullify these laws.

We overlook a basic factor in our labor situation if we fail to realize that labor's struggle for political freedom and economic security is an aspect of the struggle of people all over the world for these same objectives.

Many strikes have been declared in the past year and the publicity labor received in the press has been anything but fair. Strikes are not pleasant things for the public any more than they are for the workers who forego their weekly pay. But to claim that the strikes were the result of selfish motives and irresponsible labor leadership, thirsty for power, is utterly ridiculous. Strikes are a grim business and workers do not enjoy them; receiving strike benefits (if any) does not help the worker support his family.

The elimination by law of strikes might seem to be a simple way of protecting the public from certain inconveniences, but the evil results flowing from this easy solution would be beyond measure. The use of such anti-democratic devices to handle the labor relations problem as are contained in restrictive labor legislation would be a direct blow to the democratic process. We must, therefore, be ever vigilant against all attempts to repress the workers in the exercise of their rights whatever occasional inconvenience to some sections of the public may result. This inconvenience, inherent in the process, is a small price to pay for the greatness which is democracy.

● A 16-mm trade paper "emphatically disagrees" with the plans of the I. A. to organize the 16-mm projection field. Now isn't that just too bad. However, we hardly think that this little note of dissent will affect the plans of the I. A. in any manner, and from reports reaching this corner excellent progress has already been made in many parts of the country in unionizing the 16-mm industry.

● Ralph A. Root, business manager for Birmingham Local 236, reports a "cost of living" clause in the new agreements recently signed with the Wilby-Kincey circuit in which the projectionists receive a 10% wage boost. Similar agreements were reached with the Waters circuit and the independent theatres.

● In reading the report of the National Delegate Conference of the National Association of Theatrical & Kine Employees (NATKE) which was delivered last summer at the annual conference in London, we were very much interested in the address of General President Robert Finnigan. President Finnigan expressed the hope of a world alliance of theatrical workers, saying: "I do wish to see the establishment of a world alliance of entertainment unions. I remember this matter being raised many years ago. . . . We made contact then with the International Alliance of the U. S. and Canada and with the Dominions. The war, of course, killed any hope of progress in this regard, but I trust that efforts will be renewed, and that we shall see in our day an effective International of all unions catering to workers in the entertainment industry of their respective countries."

We wonder if the recent visit to this country of NATKE's General Secretary, Tom O'Brien, had anything to do with such a plan. Time will tell.

● We were sorry to learn of the passing of W. Edwin Grant, member of Local 182, Boston, for over 35 years. After he had been ailing for quite some time, Grant asked to be retired under a plan set up by the local. He died five days after receiving his first retirement check.

He received one of the first licenses issud in the state of Massachusetts to operate a motor-driven Kinemacolor machine (the first machine to be equipped with a motor drive). He is survived by a son and one sister.

● Additional honors were bestowed on our very good friend, P. A. (Mac) McGuire, liaison man for International

Eldorado, 1946 Style

Stratospheric earnings figures for major film companies for the first half of 1946 constitute gleeful tidings to almost everybody—except exhibitors, who are crying "cop" anent 50% percentage deals on second-rate pictures and those laboring people who want a few bucks more per week but are told off on the basis of "unconscionable costs." Here is the tally for four top companies for *six months'* operations:

Paramount: $21,792,000 *net.*

R-K-O Corp.: $6,881,352 *net.*

Loew's, Inc.: $12,579,250 *net* for 40 weeks ending June 6 last.

20th Century-Fox: $11,449,449 *net*, or double the figure for the comparable period in 1945.

From somewhere out of the valley of murky thinking echoes the refrain of a statement made only several weeks ago that the producers "just couldn't afford" higher labor costs.

Projector Corp., at the annual meeting of the N. Y. State Association of Motion Picture Projectionists, which was held last month in Geneva, N. Y. Mac was made an honorary member of the Association and also of Geneva Local 108. At the request of the officers of the Geneva Local, Mac presented Joseph Hartley, working member of Local 108 for the past 43 years, with a gold life membership card.

● The ILGWU (International Ladies Garment Workers Union) has long been recognized as one of the most progressive unions in the country. It is the first labor organization whose contracts with employers specify that the employers are to contribute a certain percentage of their total payrolls towards a general welfare fund for the benefit of the employees. This plan has worked so successfully for the past 20 years, that other unions (particularly the coal miners) have adopted it and have made it an integral part of their contracts.

● George Schaeffer, business agent for Los Angeles Local 150, recently signed a new contract with the Academy of Motion Picture Arts and Sciences for their new Academy Award Theatre. This agreement calls for 2 men per shift, 6 hours per day on a 6-day week. The chief projectionist will receive $115 per week, and his assistant $100.63. Overtime pay is time and one-half of the basic rate, computed on the basis of time worked over 6 hours in any one day.

● We received a surprise visit from an old friend of ours, who is on a withdrawal card from New York Local 306

Earl Rossman shows his commanding officer, Col. Wyatt, a native spear he picked up in Bikini.

and is a past member of the original cameramen's Local 557—Earl Rossman, chief photographer for the U. S. Army and now stationed at Wright Field, Dayton, Ohio. In our younger days we both shared many an adventure and Earl has never lost his zest for exploring the unknown. He took part in the recent "Operation Crossroads," being in charge of all photography of the Bikini atom bomb tests. He is very proud of his "pig" membership in Sty No. 1, an organization made up exclusively of men who took an active part in the atom bomb tests.

25 years ago—November 1921

● The slump was gradually dying out and business took a sharp swing upward. . . . Local 563, Danville, Va., made a remarkable comeback. The local was completely reorganized with Joe Castleberry as one of its executive officers. Joe, by the way, is still serving as an officer of the local, that of business agent. . . . The mid-winter session of the General Executive Board was called for December. . . . Heads of departments on tour received warnings from the General Office on their careless handling of the yellow report cards. . . . 79,000 garment workers went on strike in N. Y. C. . . . St. Louis Local 143 requested that a notice be carried in the International Bulletin to the effect that it had no work for out-of-town men. The local had all it could do to take care of its own unemployed members. . . . The United States Supreme Court had a case on its docket pertaining to the legality of picketing. . . . An epidemic of mooching and sneak-thievery hit many I. A. local unions. In a large number of cities, strangers appeared and played on the inexperience of local officers and hit them for as much do-re-mi as they could get away with. J. Paul Hinman, of Greenfield, Mass., ran off with the local's books and whatever else he could carry, plus a few good lenses he lifted from one of the theatres. In Grand Rapids, Mich., another chap named Earl Thatcher left town owing the Grand Rapids local a sum of money advanced to him on false representations. Dubuque, Iowa was the scene of operations for Charles Floyd, who posed as a member of the Alliance and borrowed money from the local members; and Providence, R. I. was the stamping ground for a Myron M. Pitts, who had easy pickings for a while until the town got too hot for him and he beat a hasty retreat to parts unknown.

● R. G. Bousfield, chief projectionist at the Kings Theatre, P. O. Box 478, Pietermaritzburg, S. Africa, is very anxious to correspond with several I. P. readers in this country for an exchange of ideas on what's "cooking" along projection lines. Bousfield is interested in all subjects pertaining to projection, so come on, boys, sharpen your pencils and drop a note to your fellow craftsman on the other side of the big pond.

FILM PROFITS

COMPARISON NET PROFITS AFTER ALL CHARGES (INCLUDING INCOME TAX PAYMENTS) OF SEVEN MAJOR MOTION PICTURE STUDIOS 1940-1946

Studio	1940	1941	1942	1943	1944	1945
Columbia	$ 512,186	$ 552,711	$ 1,611,659	$ 1,802,280	$ 2,055,835	$ 1,945,168
Loew's, Inc.	8,651,220	11,032,107	11,809,723	13,422,853	11,517,256	12,913,369
Paramount	6,402,131	9,206,242	13,125,437	14,584,821	14,743,106	15,425,452
R.K.O.	–988,987	1,003,491	640,312	6,912,497	5,206,378	6,031,085
20th Century-Fox	–517,337	4,921,927	10,609;785	10,901,769	12,480,492	12,746,467
Universal Pict.*	2,232,805	2,341,202	2,806,952	3,759,968	3,412,701	3,910,928
Warner Bros.	2,747,473	5,429,303	8,555,000	8,238,000	6,953,000	9,901,563
TOTAL NET FOR YEAR— 7 STUDIOS	**19,042,491**	**34,487,016**	**49,158,868**	**59,622,188**	**59,368,768**	**62,874,032**
Index Numbers . . .	1940 equals 100	181.10	258.15	313.10	311.76	330.17

% Increase Net Profits—7 Studios—1945 Over 1940—230.2%

*Universal Pictures Co., Inc. was subsidiary of Universal Corp. until June, 1943 when the two merged under the name of Universal Pictures Co., Inc. Above figures for prior to 1943 reflect net profits of Universal Corp.

—Published in The Screen Writer, August, 1946

Skouras Corp. Signs RCA Service Contracts for 65 Theatres

A major sound equipment service agreement has been negotiated between the RCA Service Co. and the Skouras Theatres Corp., providing for RCA contract service and the furnishing of replacement parts to all theatres of the Skouras organization, it was announced by W. L. Jones, vice-president of RCA Service.

The Skouras Theatres, one of the larger circuits operating in the Metropolitan New York area, comprises 65 theatres located in New York City, Long Island, Connecticut, New Jersey, and Westchester County, New York.

Negotiations were handled by J. W. Catsiff and L. M. Weber, executives of the theatre group; and W. F. Hardman, New York district manager of the RCA Service Company.

Basic Radio and Television Course

By M. BERINSKY, E.E.
Member, Institute of Radio Engineers

XXVII—SUPERHETERODYNE TROUBLE-SHOOTING PROCEDURES

IN THE preceding article [I. P. for September] the superheterodyne receiver was discussed in detail from the antenna to the detector stage. The output from the detector feeds into an audio amplifier of ordinary design and need not be discussed here. Trouble-shooting is a very important phase of radio work. Electronic equipment by its very nature is delicate and subject to frequent breakdowns. When these breakdowns occur it is the job of the radio technician, and sometimes of the projectionist, to locate the defective part or parts and to replace them. The method for locating the defective parts in electronic equipment is not difficult if a logical procedure be adhered to.

One of the most common types of radio troubles is a "dead receiver." When a radio is inoperative the best method for locating the trouble is by signal substitution. The purpose of a radio receiver is to receive an a.c. signal which is sent out into the ether by a transmitter, and to transform that signal into speech or music. As the signal moves through the receiver its form and frequency may be changed several times, but it still remains an a.c. signal.

When a receiver is inoperative, the most logical procedure to follow is to trace the signal through the receiver, beginning at the loudspeaker and moving towards the antenna. A signal of the type that is found in a particular stage of a receiver is substituted in the various stages of the inoperative receiver. When the signal fails to pass through a certain stage, that stage is defective. This method of analysis is known as "signal substitution."

Preliminary Testing Steps

This method of trouble-shooting will now be explained in detail with reference to a superheterodyne receiver. A signal generator of good design will be very helpful for this type of work. The generator should cover the usual frequency range of from 100 kilocycles to 30 megacycles, and, in addition, should have a separate audio frequency output of 400 or 1000 cycles.

Starting with the audio power amplifier, an audio signal is applied to the plate of the power amplifier tube. This signal should be very strong because there is no amplification present at this point, and a strong signal from the generator is necessary if it is to be heard in the loudspeaker. If the signal is not heard in the speaker and normal voltages appear at the tube elements, the defect is obviously in the speaker system. Common troubles at this point are open speaker voice coils, open field coils, shorted coils, and open or shorted audio output power transformers.

A resistance check with an ohmmeter will disclose the defective component. A defective field coil can be located very easily by placing the blade of a screwdriver against the magnetic yoke of the speaker. A strong pull should be exerted on the blade by the speaker's magnetic field. If this pull is missing, a defective speaker field coil is indicated. Should the signal from the generator be heard at this point, we may safely assume that the circuit between the speaker and the plate of the output tube is functioning properly.

The next step is to place the probe from the signal generator on the grid of the power amplifier tube. At this point the volume of the signal should increase considerably due to the increased audio amplification of the power amplifier tube. If the signal strength does not increase considerably, the tube is probably defective and should be replaced. If the tube uses an indirectly-heated cathode, the cathode bias resistor will probably be by-passed to ground by means of a large condenser. [This condenser is sometimes omitted when a beam-power tube is used.]

When this condenser is defective, hum and distortion will result. The condenser can be tested by applying the signal from the generator between cathode and ground. If the condenser is good, a weak signal should be heard in the speaker. If the signal is rather large, the condenser may be open; if no signal is heard, the condenser will probably be shorted.

Audio Voltage Amplifier Tube

The next stage in a typical superheterodyne receiver, as we move towards the antenna, is the audio voltage amplifier tube. In most modern receivers this tube is a duo-diode triode which serves both as a detector and first audio amplifier stage. The audio test signal should next be applied to the plate of the audio amplifier section of the duo-diode tube. This signal should be heard in the speaker. If the signal fails to pass through the circuit, the fault usually lies in the coupling condenser which is connected between the plate of the voltage amplifier and the grid of the power amplifier.

Assuming that the signal passes through this condenser, it should next be applied to the grid of the voltage amplifier tube. A very large increase in signal strength should be noted at this point. If the signal fails to increase in strength or is entirely absent, a defective tube is indicated. The signal is next applied to the diode plates of the duo-diode triode tube. At this point the signal strength should decrease, but it still should be audible if the circuit under test is operating properly.

If the signal fails to pass through the circuit under test, the diode section of the duo-diode tube will probably be found to be defective. A tube tester will indicate the condition of the tube with a reasonable degree of accuracy.

The next tube in the circuit, moving towards the antenna, will be the intermediate-frequency (IF) amplifier. This tube is a voltage amplifier of the pentode type. Reference to a circuit diagram of a superheterodyne receiver will disclose that the IF amplifier is connected to an IF transformer. The primary of the IF transformer is connected to the plate of the IF voltage amplifier and the secondary of the transformer is connected to the diode plate or plates of the duo-diode triode tube.

The IF transformer has a resonant frequency of 456 kc in most receivers. The exact IF of the transformer which is used in the receiver under test should be ascertained before proceeding with the test. This frequency will be found on the circuit diagram of the receiver. Circuit diagrams may be obtained from the manufacturer of the receiver, in various radio magazines, or in Rider's Manuals.

Using the Signal Generator

When the IF of the receiver is established, the signal generator should be adjusted to that signal. When the generator has been set to the proper frequency, no difficulty should be experienced in trying to send a signal through the transformer. The signal generator lead should be connected to the plate of

the IF voltage amplifier when testing the transformer. If the signal fails to pass through the transformer, the part may be defective or out of alignment [to be covered later].

Usual defects of IF transformers are open windings, shorted windings, and defective trimmer condensers. A resistance check with an ohmmeter will disclose whether the transformer is open or shorted.

If the signal passes through the transformer, it should next be placed on the control grid of the IF voltage amplifier tube. At this point the signal strength should increase several times due to the amplification of the tube. If the signal does not increase in strength, a defective tube is indicated and the tube should be inserted in a tester to determine its condition.

Reference to a circuit diagram of a typical receiver will disclose that the control grid of the IF voltage amplifier tube is connected to the secondary of another IF transformer. The primary of this transformer will be connected to the plate of the mixer tube. This transformer is known as the input IF transformer and its resonant frequency will be the same as the output IF transformer which we have just finished testing. The signal should now be connected to the plate of the mixer tube. A loud signal should be heard in the speaker if the transformer is functioning properly. If the signal fails to pass through the IF transformer, an open or shorted winding is the probable cause, and a resistance check should be made of the primary and secondary windings.

Primary and secondary windings have approximately the same resistance, this value usually varying from 20 to 100 ohms. If the winding is open, the meter will not move or will indicate a very high resistance. A shorted winding will read zero ohms or a very low value. If the signal passes through the input IF transformer, the receiver is functioning properly between the point last tested and the loud speaker

The signal lead from the generator should now be connected to the signal grid of the mixer tube. The signal strength should increase at this point, if the circuit is working properly. If the signal decreases or is absent at the grid of the mixer, a defective mixer tube is probably the cause. The tube should be checked in a tester if the aforementioned defect exists.

Local Oscillator Stage

The local oscillator is the next stage to be tested. The receiver dial should be set to some frequency like 600 or 1500 kc. The signal generator should also be adjusted to the same frequency, and if the local oscillator is operating properly, a signal should be heard in the speaker. In the absence of a signal at this point, the local oscillator coil should be given a resistance check in order to determine its condition.

The component parts which make up the oscillator circuit are somewhat critical and they should be checked thoroughly in the event that the oscillator coil is in good condition. Sometimes the oscillator grid resistor changes value and causes the circuit to go out of oscillation. A resistance check will determine the condition of this resistor.

The oscillator tube often fails to oscillate. Most tube testers will not show the tube to be defective, although it fails to work in the receiver. Substituting a new tube will indicate if this type of trouble exists.

The last circuit which remains to be tested is the antenna coil. If the signal passes through the receiver from the mixer grid, it is an indication that the receiver is working properly up to this point. The signal generator is then transferred to the antenna terminal of the receiver, while the generator and receiver dial settings remain unchanged.

If a good signal is heard in the speaker, it is an indication that the receiver is in good condition. If, however, the signal is very weak or fails to pass through the antenna terminal, it is an indication that the antenna coil is defective. The antenna coil may be open or shorted in either of its windings, and a resistance check with an ohmmeter should indicate the source of the trouble.

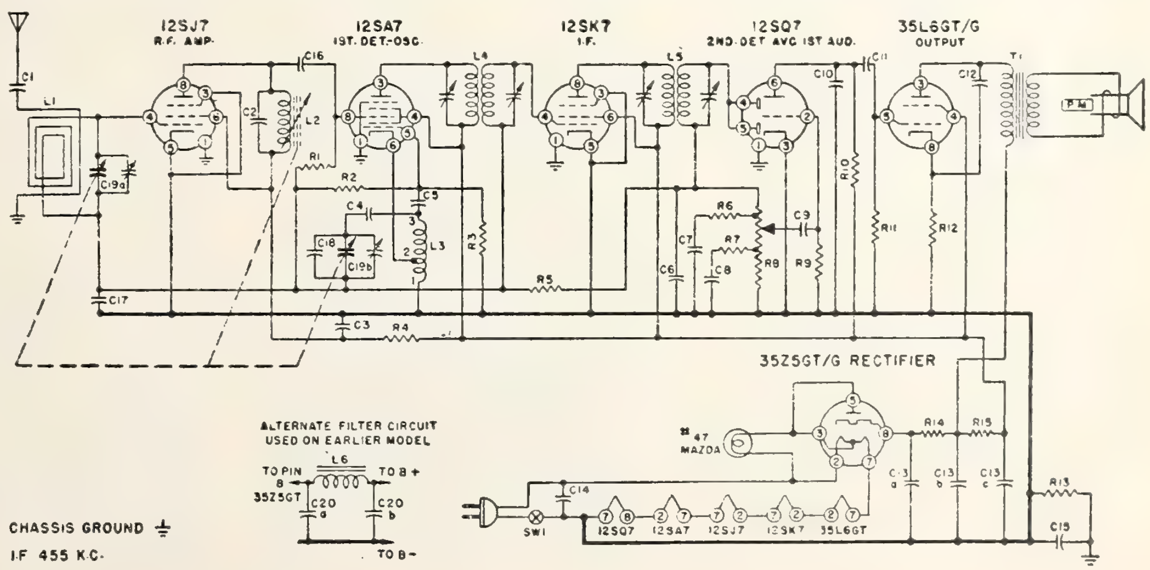
Voltage Analysis

The signal substitution method of trouble-shooting is invaluable as a means for locating a dead stage in a radio receiver or amplifier. Once the dead stage has been located, however, it is somewhat more difficult to locate the defective part. The ohmmeter and the voltmeter are most useful when it comes to localizing the defective component in the inoperative stage of the receiver. The resistance check simply involves testing each component in the defective stage and comparing the reading with the color code on the resistor. This meter is also useful for locating open or short circuits.

All tubes in the receiver operate with certain voltages on their elements. A voltage check at the elements of the tubes will indicate the existence of any

SEPTEMBER QUESTIONS AND CORRECT ANSWERS

1. ***(Q)* Why is a superheterodyne better than a T. R. F.?**
   ***(A)* A superheterodyne has better sensitivity and selectivity than a tuned radio-frequency receiver.**
2. ***(Q)* Why is AVC used?**
   ***(A)* AVC is used in order to minimize the effects of fading and to prevent blasting when tuning from a weak station to a strong one.**



Schematic of a superheterodyne receiver with common trouble-shooting points prominently displayed.

Notes From the Studios

Transparency Set Turntable

By JOHN ALTON, A.S.C.

ONE of the most important but least publicized departments in motion picture production is the *background process* or *transparency department.* It is the director of transparency and his assistants who put the wildest imaginable scenes on the screen. Without exaggeration, this department saves the industry hundreds of thousands of dollars annually. Perhaps that's the reason that so little thought has been given to streamlining the process stage, but, as this article will convey, there is ample room for improvement.

When we shoot a scene on the process stage, usually several angles of the same scene are necessary for cutting purposes. As the scene is shot against the screen, if we want another angle, the set has to be changed around. Where the budget is limited, this added take is eliminated, thereby weakening the picture.

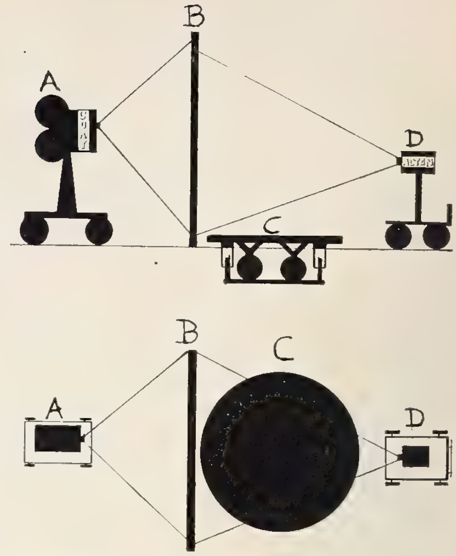
To illustrate: Suppose we are shooting the interior of an automobile. First we shoot the straight-on angle. When that is "in the box" the director wants another, perhaps a three-quarter angle. The car has to be moved around. The motor is running and soon the stage is filled with poisonous carbon monoxide gas. The cast and crew complain of headaches; they are sleepy, drowsy, which results in a slowdown in production. Nobody even seems to suspect the real cause of the trouble.

Time-Consuming Changes

The car is finally put into its place, the scene is rehearsed, the lamps that had to be moved are brought back, the scene is relit, the plate is matched—all ready, and the second angle is shot. However, all of this took a long time; and if we want to have a reverse shot of the scene, that is going to take more time, and the production time means money.

An automobile is easily moved. But suppose we have a more complicated set, a South Sea island, palm trees, huts, fishing nets, etc., or any other type of construction. What then? Suppose it be a Pullman car? Either the director is discouraged from taking more angles and the quality of his picture suffers, or it means a complete reconstruction, re-dress, and re-lighting.

The construction department is asked for more men to move the awkward scenery. So we wait, the set is broken down, the lights and props moved, and while all this construction goes on, the entire crew and cast are compelled to



FIGURES 1 (top) and 2 (bottom). Turntable for transparency stages.

sit around. This very expensive procedure is repeated every time a new angle is desired.

For years I have been searching to replace this rather primitive system with a faster, more economical but at the same time practicable method. At last I have hit upon a solution. The answer is a built-in turntable on the process stage, in front of the transparency screen. Its installation might seem a bit costly, but it will more than pay for itself the first year in terms of its obvious advantages. Figs. 1 and 2 show this turntable in side and top views.

A is the projection machine.
B is the transparency screen.
C is the turntable.
D is the camera.

Sets Built on Turntable

Vehicles are placed and sets are built right on top of the turntable. As the lights are not going to be removed, they can be rigged and left there. This in itself means a considerable gain in time. When we want to change the angle, all we have to do is press a button, watch the set turn, and pick the exact point. Anyone with a little imagination can immediately grasp the unlimited possibilities which open up with the use of this new production aid.

I am fully prepared for some criticism. Reforms of any kind, inventions, are never universally welcomed. Remember this is offered as an idea only, subject to improvements, as sometimes one idea induces a train of thought that goes places.

Considering the enormous saving of time this turntable idea offers, it is up to the writers, directors and cinematographers to follow through and take advantage of it.

(Continued from preceding page)

abnormal potentials. The service notes which accompany the receiver will usually have a table of proper operating voltages for the various elements. In the absence of such a table, the tube manual should be consulted for approximate voltages.

The usual type of voltmeter will not indicate accurately the voltages which exist across a high resistance. Such would be the case when measuring control grid voltages or AVC voltages. For such measurements, a high-resistance meter such as a 20,000 ohms/volt voltmeter or a vacuum tube voltmeter should be used.

The first check which should be made on a receiver regardless of its apparent defect is a measurement of the B-plus voltage at the output of the rectifier tube. If no voltage exists at this point, a shorted filter condenser, open power transformer, or defective rectifier tube is indicated. If the B-plus voltage is approximately half of its normal value, the first filter condenser is probably open. If the receiver has an excessive amount of hum, the second filter condenser is to be suspected.

The voltage on the grid of a tube should be negative and should be measured from grid to cathode. All other voltages may be measured from the tube element to ground. If a positive voltage is found on a grid, it will usually indicate a leaky coupling condenser. The local oscillator can be checked rapidly by measuring the oscillator grid voltage with a vacuum tube voltmeter. If a fairly large negative voltage does not exist at this point, the circuit is not oscillating.

NOVEMBER QUESTIONS

1. Which method of trouble shooting is usually best for locating a dead stage?

2. Which method is best for locating an open or shorted coil?

3. Which method is best for locating a defective power supply?

The answers to these questions will appear in the next issue.

Trade Unions in America

By JOHN P. FREY

President, Metal Trades Department, A. F. of L.

This is the first of a series of articles constituting excerpts from the book "Craft Unions of Ancient and Modern Times," which was privately published and copyrighted by this militant American labor leader. Subsequent installments will chart the progress of organized labor from the earliest known to modern times.

THERE is no complete history of the craft unions of antiquity. None will ever be written. The records of these workmen's unions were not kept. The names of their leaders are unknown. Such references to them as are found in inscriptions deal with the craft as an organization and some of its activities, but the leadership is unmentioned. The student of today, however, can discover ample evidence of their existence and the part they played in their country's development. Evidently they took a prominent part in protecting the members' wages and craft interests. In countries where they had the rights of citizenship, as in Rome, they were also politically active, at times electing members to responsible public office.

The historians of the early days, like many of that fraternity today, were uninterested in the workers and their organized activities. They chose the wealthy or the dictators as the subject of their writings many of them being sycophants as is shown by their works, catering to the vanity of some powerful individual for the reward which might be received. It was the record of rulers, great and little, of generals and other warriors, of military campaigns of national defense or of conquest which received their attention.

They wrote of theology, philosophy of government and history in general, but scarcely mentioned the craft unions which, during the period of the Roman Republic, were the nation's backbone and the nation's staunchest defenders of free institutions under a representative form of government.

The ancient playwrights referred to labor as uncouth, smelly clowns, as clods, one reason being their desire to cater to the dislike and fear of the favored classes and the nobility for the strength and the militancy of the craft unions.

First Dependable Reference

The first dependable reference to these unions is the administrative orders or laws promulgated by Solon, the greatest of Greek lawmakers, B.C. 639-559, and those of Numa Pomilius, first king of Rome, B.C. 715-672. It may well be that Solon was aware of those proclamations giving official status to craft unions in Rome before he "brought trades into credit."

It should not be taken for granted that Solon and Numa Pomilius created craft unions, or that they determined the form of organization they should have. The craft unions had existed for a long period before these two great and wise rulers gave the crafts a legal standing which they had not previously possessed.

It was not wholly a question of justice to the crafts; that was evidently a secondary consideration. Both countries were growing, the size of the armies was increasing. Buildings, homes, palaces and temples must be constructed by imported or by native labor. It was to create a large organization of native craftsmen and enable the country to carry on an export business which originally led to the governmental fostering of the crafts. It was the application of a sound national, economic policy which had no minor part in the development of ancient Greece and Rome.

This is no idle assertion or effort to make a questionable point. Plutarch in his life of Solon is quite explicit. In part he wrote:

"Observing the city to be filled with persons that flocked from all parts into Attica for the security of living, and that most of the country was barren and unfruitful, and that traders at sea import nothing to those that could give them nothing in exchange, he turned his citizens to trade, and made a law that no son be obliged to relieve a father who had not bred him up to any calling." Solon "brought trades into credit." He gave the craft a favored as well as a legal status.

In those early days there were no textbooks or classes where economics, sociology or social economy were taught. The teachers of that period were evidently backward, at least to one extent. They had not conceived of the profession which has begun to develop in our country through which young men and women who are not presumed to be mechanics employed in industry can be prepared to take over the management and program making for our modern trade unions, and by their superior education (?) guide the unions into the uncharted sea of ideals, so that our world will be a better one.

Crafts' Natural Development

The craft unions of antiquity had no model to guide them. Their structure, their form of organization, their bylaws grew in the most valuable school of all—the hard-headed school of practical experience.

Organization was a natural development, stimulated wholly by the development of craft skill and contact with others of the same craft. As civilization developed, skilled workmen were essential, better clothing must be provided, agricultural tools, though these were most simple, had to be manufactured in continually larger volume. Armies must be provisioned with weapons and armor, the production of which called for not a little craft skill. Huts as dwelling places were being replaced by villas requiring the labor of skilled building craftsmen. Castles, military fortifications and temples were being erected. The number of craftsmen and their skill as mechanics increased rapidly.

There were no large workshops. The craftsmen worked largely alone except for an apprentice whom they might have consented to teach the "art and mysteries" of the craft. But the craftsmen, their homes and little workshops were generally located in a particular quarter of the city. In Rome a number of streets were given over to craftsmen, for we find a sword-maker's street and others named for the sandal-makers, the shield-makers, the spear-makers, the helmet-makers, the bakers, etc.

Crafts Politically Powerful

Their close daily contact with each other, the necessity of protecting their craft interests, the problem of securing an acceptable wage, their common interests, led them in a most natural manner, to organize the first craft unions which, in the passing of hundreds of years, developed into organizations with ambitious policies, detailed constitutions and by-laws. In lands such as Rome where the craftsman was a free citizen, the manufacturing and the building crafts were a power which the Senate was compelled to constantly keep in

(*Continued on page* 34)

Projection Rectifier Tube Data

By J. K. ELDERKIN
Forest Manufacturing Corp.

Not a few of the complaints anent operating troubles of projection bulb-type rectifiers are traceable to the substitution of mercury vapor tubes for the argon type. The characteristics of these two types of tubes and their applicability to projection rectifier service are set forth in the appended article by an acknowledged authority on rectifier performance.

PROCEEDING on the theory that the world needs not so much to be told as to be reminded, this restatement of facts anent projection rectifier tubes is offered. Projectionists have a penchant for substituting tubes utilizing mercury vapor instead of argon as the gas medium in the glass envelope, for what reason the writer is unable to fathom. The use of mercury vapor tubes will cause serious trouble in the rectifier itself and be the direct cause of rather expensive repairs.

To aid in a clear understanding of the subject it seems advisable to describe briefly the operating characteristics of tube types commonly used in projection rectifiers and to cite some causes of failure and their remedies.

We shall consider first the argon gas-filled type with tungsten filament or cathode. This is the most widely used and best-known rectifier tube in the projection field, and is commonly called the "Tungar-type" because this was its trade name when it first appeared on the market. Now being marketed by several manufacturers, it will be referred to hereafter as the "argon tube" to distinguish it from the "mercury tube."

Components of Argon Tube

The argon tube consists of a hard glass (Pyrex) envelope in which is a filament of coiled tungsten wire supported by two tungsten wire electrodes. The two electrodes are used to carry current for heating the coiled filament, which in the case of the 15-ampere tubes requires 2.5 volts and approximately 27 amperes. One of the electrodes, besides conveying filament current, also carries the main current being rectified, which may be an additional 10 to 15 amperes.

The filaments are supplied with current from separate low-voltage windings on the transformers, or, in some cases, from a separate filament transformer. The two filament electrodes are, of course, sealed into the glass envelope by air-tight glass seals at the base of the tube, and these terminate at the brass screw-type base (Mogul-type).

Onto the top neck of the envelope is sealed a single tungsten electrode extending toward the filament, and to the lower end of the electrode is secured a graphite or carbon button which serves as the anode or plate electrode. The end of this electrode extending through the top of the envelope is sometimes the tungsten wire itself, or, in other cases, a flexible copper wire is welded to the tungsten for the purpose of making better contact to the terminal clip connecion of the rectifier.

Usually there is a white plastic material surrounding the anode lead where it comes out the top of the envelope. This material is commonly thought to be an air-tight seal; but it is in no sense a seal, being merely protection to prevent over-flexing of the anode wire lead.

The glass tube thus built is carefully exhausted and the electrodes freed of gases as much as possible; after which a small quantity of pure argon is put in the tube, and the tubulation by which the tube has been exhausted is sealed. Before sealing off, a small quantity of magnesium or other alkaline earth metal has been placed inside to be used as scavenger (getter). This scavenger metal is exploded or volatilized within the confines of the envelope by means of an internal or external heating means called "bombardment."

The purpose of the scavenger metal is to absorb or unite with deleterious or destructive gases that might later be given off by the electrodes, by the walls of the glass, or in combination with the argon, thus keeping the contents of the envelope free from impurities that might tender the tube inoperative.

The tube thus described is, of course, a half-wave rectifier which, briefly stated, operates as follows: The tungsten filament when heated to proper temperature gives off a stream of electrons some of which collide with the argon gas molecules, thus giving a secondary emission sufficient to allow a flow of considerable current between cathode and anode.

The resistance to the passage of current through the tube in one direction is very slight; but its resistance to the passage of current in the opposite direction is very high, so that it might be compared with a check valve in a fluid system, blocking the flow in one direction and offering very little reistance to the flow in the opposite direction. Rectifier tubes thus have come to be called valves. This valve action, discovered by Thomas A. Edison, has for many years been known as the "Edison effect."

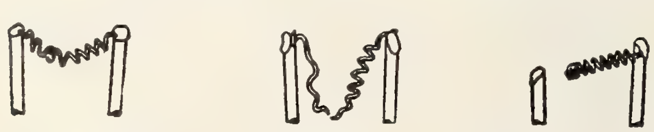
'Critical Voltage' Factors

The valve action of a rectifier will break down upon the application of a plate voltage higher than that for which it has been designed. This is called the "critical voltage." The critical voltage depends upon several factors, including the shape and number of electrodes in the tube, the space between the electrodes, operating temperature, and the kind and quantity of gas in the envelope. The critical voltage of the argon tube described is considerably lower, for instance, that that of a tube using mercury.

This brings us to consideration of the mercury tube designed to be used in place of the 15-ampere argon tube. Outwardly the two tubes are just alike, but the internal structures differ in the following respects:

Instead of the coiled tungsten filament of the argon tube, an oxide-coated or so-called indirect-heater type of cathode is used. The cathode consists of a metallic barrel plate, ribbon or screen of considerable surface area and coated with white oxides of barium or strontium, or both, and designed to be heated to a low red temperature by a coiled heater element in contact with it. Instead of argon gas, a small quantity of mercury is used which, when heated, gives a slight mercury vapor pressure in the envelope comparable with the argon gas pressure in the argon tube.

In operation the oxide-coated cathode gives off a stream of electrons, the same



Bulb run over 1000 hours. — Bulb run over 4000 hours. — Bulb reversed or flashed back.

SHOWING VARIOUS STAGES OF FILAMENT DETERIORATION

as the tungsten filament first mentioned, but, of course, the electron emission from the oxide cathode is obtained at a much lower temperature. Electrons escaping from the cathode collide with gas molecules of the mercury vapor (similar to argon tube action) and large currents can be passed between cathode and anode.

Difference in Operation

In operation there is one very great difference between the two types of tubes: the argon tube is instantaneous in operation, that is, no time is required for the cathode to heat up and thus pass the plate current. The mercury tube, with its oxide cathode, requires that the cathode must first be energized and sufficient time elapse for it to become emissive before the plate current can be applied.

The purpose of this article is to show why the selection of the mercury-type tube for use in place of the argon tube in a projection rectifier is a grave mistake and one to be avoided. I am not condemning a mercury-type tube, because in certain rectifiers and certain applications thereof a mercury tube would be proper, and, in fact, under certain conditions the only type that could be used successfully. However, a projection rectifier designed for argon tubes does not fall in this category.

A mercury tube intended to replace an argon tube in any rectifier should be very carefully considered from all angles before making the swap, otherwise costly troubles may ensue. In support of this opinion the following anent rectifiers for projection is offered:

1. The rectifier is designed with considerable reactance or inductance for smoothing the current and for limiting the arc-striking current, thus quite severe voltage surges are created upon loading or unloading the rectifier, and, to some extent, when sudden changes occur in load current. The only way this surge can be prevented is by opening the a.c. input to the rectifier tubes instead of breaking the d.c. output circuit from the rectifier.

When the mercury tubes are substituted for argon tubes in the rectifier it is customary to break the d.c. output circuit to extinguish the arc and to leave the a.c. input alive in order to keep the cathodes of the mercury tubes heated. Operating in this way induces a surge in the rectifier which, passing into the transformer windings, causes the insulation of the transformer to break down, requiring an expensive repair or replacement job.

With the argon tube, the a.c. input to the rectifier is opened to extinguish the arc (it is not necessary to keep the cathodes energized as is the case with mercury tubes) therefore the surge is prevented and no damage is done to the transformer or tubes.

Protective Feature Lacking

2. The critical voltage of the mercury tube is much higher than that of the argon tube, which means that the mercury tube will withstand a higher peak inverse voltage than the argon tube.

When argon tubes are used in the rectifier and surges occur, due either to cutting off the arc on the d.c. side or to severe changes of load current at the arc, there will be no damage done to the transformer, because when the inverse peak voltage of the surge is high enough to damage the transformer, it is higher than the tubes will withstand, with the result that the valve action of the tubes will be destroyed.

With a properly designed rectifier, the instant the valve action of the tube is destroyed there will be an increased flow of current within the rectifier circuit itself which will immediately snuff out or suppress the surge, resulting in no damage to either the rectifier or the argon tubes.

In all of the earlier rectifiers, and even in some rectifiers made today, the protective feature just described does not exist because, frankly, of lack of knowledge of how to incorporate that feature.

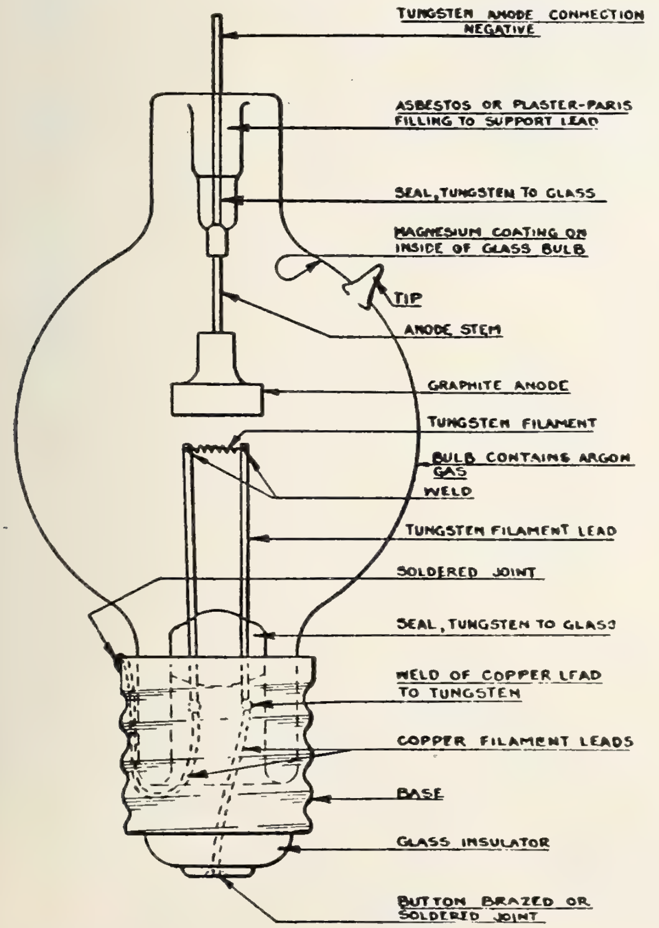
When mercury tubes are substituted for argon tubes this protective feature is non-existent. In rectifiers using argon tubes and having this protective feature, the worst that can happen is the loss of a tube due to a destructive surge. The replacement of a tube is a simple, quick and inexpensive remedy; whereas the repair of a transformer is not simple, requires time and, of course, involves considerably greater expense.

Substitution of mercury tubes for argon tubes in the aforementioned type of rectifier will cause breakdown of the transformer rather than breakdown of the bulb, because the mercury tube withstands high peak inverse voltage and passes this high voltage on to the transformer, as previously explained.

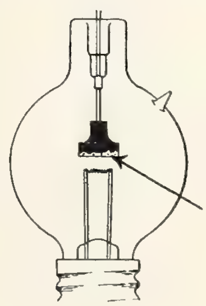
3. The rectifier is designed with proper filament windings for the argon tube filament requirements, and the available wattage is not sufficient, in the writer's opinion, for the oxide cathode of a mercury tube of proper design to have an equal rating to an equivalent argon tube. Therefore, in designing a mercury tube to use the available wattage of the filament circuit of the rectifier designed for argon tubes, it is obvious that such a mercury tube will have insufficient cathode to assure even reasonable life.

There are other reasons why the mercury tube should not be substituted for the argon tube, but sufficient data has been given to cause projectionists to

(*Continued on page* 31)



(Left) Diagrammatic representation of argon tube specifications.



(Above) Bulb with air leak or defective gas filling. Arrow indicates blue or white coating.

IP AT YOUR SERVICE

This department is devoted to the man behind the man behind the gun—the serviceman. Its prime purpose is to promote a closer relationship between projectionist and serviceman based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. Contributions from both groups are invited.

DETERIORATION of rubber parts in sound-heads, such as motor mounts, due to exposure to oil has always been a source of trouble and expense. A coating of ignition seal, a flexible, quick-drying liquid for painting ignition wires to prevent high-voltage leakage, has definite oil-deterrent characteristics when applied to rubber parts and extends the life of such parts.—W. H. HOWARD, *RCA*.

Forming an Oil Shield for Simplex Soundheads

On Simplex soundheads the oil shield does not have the edge rolled up on the operating side. With E-7 projectors the edge of the projector can be filed off at a 45-degree angle, and then the edge of the oil pan can be bent up sufficiently to prevent the oil from running into the film compartment or down the soundhead door.—E. WILLIAMS, *RCA*.

Measuring Rectifier Tube Current

A handy device to measure current of the No. 29225 rectifier bulbs can be made by taking two thin strips of spring brass and cementing them to a strip of mica or cardboard, then soldering an alligator clip to each end of the strip. The clips make it convenient to clip the test leads on. Once the proper polarity has been determined, the positive side should be painted red so that the current can be measured while the show is running without interruption.—HAL PROSSER, *RCA*.

Commutator Sanding Paper

I have found a sandpaper that comes in rolls of an inch width and is perfect for cleaning commutators, contacts, etc. It is called flint paper roll for commutator sanding. It is about the size of a roll of friction tape and is easy to carry around. It is available at most automobile supply stores.—A. J. SPEAK, *RCA*.

Handy Tool for Installing No. 28039 Fader Springs in the MI-9701 Fader

A very handy tool for installing stock No. 28039 springs in MI-9701 fader units can be made from a 4-inch piece of 1/4-inch OD copper tubing and a steel rod that will slip into the tubing and a couple of washers soldered to these and a spring to create tension. This simple tool is shown in Fig. 1.—H. M. MORROW, *RCA*.

Procedure for Testing Fuses

Failing fuses usually offer trouble symptoms for a considerable length of time. A method of detecting developing use trouble has been proven by experience. With monthly tests of F-3 on panel of TA-7276 power unit, four fuses have been rejected from three systems over a two-year time period. The test involves the use of a Weston 772 voltmeter, and two fuses for purposes of comparison.

1. READY with normal supply established. SET range for 50-volt scale. GO for meter repair if fuse is open and LO range is set too soon.
2. The 10-volt scale deflection will indicate polarity.
3. On the 2.5 scale, needle will deflect about four divisions (0.1 volt).
4. Replace with a spare fuse and repeat aforementioned steps. Lead-pencil the figure four (4) on panel near positive end of fuse for future reference. Suspect the fuse rather than any change in supply or lead condition when future checks indicate higher voltage developed. Heat that develops with no fuse voltage increase, will indicate a bad physical connection.—R. L. BRIERLY, *RCA*.

Continuity Break on Changeovers

On Simplex equipments where there is too much of a break in sound continuity on changeovers, check the preheat voltages. The chances are that you will find it below normal. It can be remedied by changing the primary tap on the transformer which supplies the preheat voltage, from the 125-volt tap down to the 115-volt tap. This shortens the filament lag time on the changeover.—G. H. BENJAMIN, *RCA*.

Du Pont Buys Smith & Aller

Du Pont has announced the purchase of Smith & Aller, Ltd., distributors of Du Pont products on the West Coast for more than 20 years. Concurrent with the transfer Du Pont will open a West Coast district sale office at 6656 Santa Monica Blvd., Hollywood, for the distribution of motion picture film, x-ray film, photographic papers, films and chemicals.

New RCA Service Contracts

RCA Service Co., Inc., has renewed contracts with two of the largest U. S. theatre chains—National Theatres, comprising 300 houses in the Fox West Coast, Evergreen, Intermountain, and Wisconsin divisions; and the Fox Midwest group.

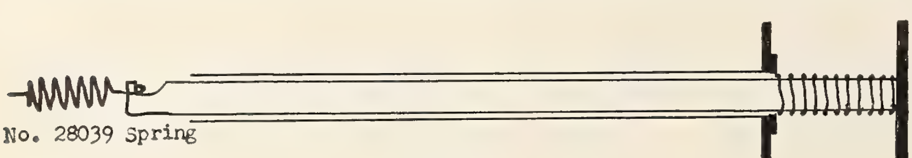


FIGURE 1

TELECASTS

(*Continued from page* 16)

over a period of time. But at this point it is interesting to note that many of our early sets are still in daily use after eight years, and the cost of their upkeep has been relatively insignificant, considering the length of time they have given service.—Ernest Marx, Du Mont Labs.

1 *Million Receivers in* 1947: We must set an objective for our industry to produce not less than 750,000, and if possible, 1,000,000 television receivers in 1947. If we make a low estimate of a fair market average list of $200 each, this would mean a 200 million dollar retail business for the industry in 1947. There is some question whether $200 will be a realistic average price projected at today's production costs. It may be higher, particularly when installation costs are added, so that 200 million dollars would seem a realistic and readily attainable objective. — Ernest H. Vogel, Farnsworth Radio & Television Co.

Commercials on Film: Putting a commercial on film has both advantages and disadvantages. For a one-time, one-station shot, it's pretty costly. If you try to beat that by using the same strip of film time after time without change, you get viewers in a mood to throw rocks through the set—or more reasonably, to turn down the audio and chat until it's over. I have seen that happen scores of times. In the future, when an advertiser may be on many stations, a library of commercial shorts will be valuable, for these can be conveniently sent from station to station and the cost per showing can be brought down.—C. J. Durban, U. S. Rubber Co.

Tele Pulling Power: Television has already proved to Gimbel's its importance in selling merchandise, combining the best features of radio and space advertising with motion. If the effectiveness of any form of advertising is to be judged by sales, the Gimbel programs have been highly successful, even though the expense is high in terms of consumer coverage.—David Arons, Gimbel's, Philadelphia.

Radio's "Zenith of Repulsiveness"

Video Commercials: It took years to develop the radio commercial to its zenith of repulsiveness. If this thinking carries on in television, then if the industry survives (which in my opinion it could not) the television audience may expect intermittent periods of one to five minutes duration throughout the broadcast day devoted, it will seem, to the sole purpose of insulting public intelligence.

If one picture is worth a thousand words, then one visual commercial can be a thousand times as bad as the most objectionable aural message. On the other hand, properly handled, a brief but well-integrated visual commercial will sell a thousand times as well as the best aural one.—Len Cramer, Du Mont Labs.

Film Sequence Production: While at the moment we do not have what may be called an organized motion picture section, we are equipped to produce incidental sequences which our scripts may require. Recently we have filmed numerous public events and this type of service will be extended as early as practicable.—G. E. Markham, WRGB, Schenectady.

* * *

The C. J. Hooper survey reports that 141,375 persons saw the recent Louis-Conn fight by television in homes alone, with thousands more viewing the sight in public places. Video trade conclusion: television was the real winner of the bout.

* * *

Here is RCA's Television Owner's Policy plan: (a) factory-guaranteed service for the customer; (b) maximum sales revenue for the dealer without time and service expenses; (c) installation, servicing and maintenance initially by RCA technicians.

Under the plan, for a nominal charge, according to receiver model, each purchaser will receive: an RCA antenna, installation of receiver and antenna by RCA factory engineers; instructions in care and operation of the receiver; a year's service; maintenance and parts replacement, including kinescope if necessary; and, as new stations open in the region, orientation of receiver and antenna to them at no extra charge.

* * *

Video will play an important part in the educational field, both in schools and colleges. The N. Y. City School System has announced that it will purchase 293 tele receivers. Chicago schools are already using tele.

VIDEO AND MOTION PICTURES

(*Continued from page 8*)

easiest method of syndication, a "celluloid network."

Another very practical reason why films have been widely used during television's first years, when equipment and good studios were scarce and skilled personnel even more so, is that entertaining programs can be filmed with regular motion picture techniques. The public prefers the most entertaining material available, and the chances are that the established film companies will be able to compete successfully on this score for some time to come.

Then, of course, there are certain uses of motion pictures which are standard practice, just as there are certain fixed uses for electrical transcriptions and recordings in radio. Programs can be transcribed on film for reference purposes as well as for later rebroadcasts in different time zones; or they may be even flown to Europe or South America by airplane to establish a form of international television before such networks can be built. Films may aslo be used to record news events which may happen at odd hours of the night, when there is little or no audience looking in. These films are then telecast at a time when the audience is tuned in.

Video's Speed of Transmission

Perhaps it all boils down to this: motion pictures are going to play an important part in television no matter how one looks at it. The obvious conclusion is that their use parallels that of electrical transcriptions and records in radio. Some stations may be primarily film-playing telecine stations. Perhaps, as in radio, these may be the smaller, independent stations. Other television stations, affiliated closely with networks, may tend to broadcast more and more "live" shows with each passing year.

In short, film can be transmitted over television, just as easily as a "live" program. But, *although motion pictures can provide a permanent record for television, they cannot transmit television in its true sense—cannot retain its speed of communication, its immediacy.*

Fundamentally, television exists only at the instant of its transmission and then is gone forever. In this it is like the human eye and ear, without any permanence, without any memory, for in human beings it is the brain which does the remembering. Motion pictures differ from television in this respect, since film contains a permanent record of what has been seen and heard, a record which can be taken out of the storehouse and repeated at any time. Television can acquire a "memory" by being recorded on film either at the point of origin or directly off a receiving set.

Because television can use stills or motion pictures to repeat things which have happened in the past, it is not restricted to "live" programs, which must progress without interruption from start to finish with the production of one sequence following another. The fact that previously prepared and photographed material can be inserted at any point, just as in motion pictures, gives television a potential scope and flexibility which equals or exceeds that of the film.

There are various psychological

aspects of motion pictures which seem to hold true in television. For instance, we cannot concentrate our attention on more than one thing at a time. This means, in television production, that at any given instant one must have the audience's attention focused on either the visual or the aural part of the program, *but not equally on both.* [Since television is predominantly a visual medium, the attention will usually be on the video.] The moment both audio and video become equal in importance, the audience becomes distracted and confused.

Visual-Aural Demands on Interest

How many times have you been watching a motion picture and suddenly become conscious of the music. The chances are your attention was flitting back and forth from the sound to the picture, causing confusion and breaking the mood of the story. In early television a particularly noticeable example has been found in sports programs, when a typical radio sports announcer handles the commentary. Accustomed to working in a "blind" medium, he rattles on describing everything. Unfortunately, the audience can see all this before the announcer can begin to talk about it, and the effect is confusion and irritation. The most successful sports announcers of television are those who know when to keep quiet; in most cases these more successful announcers have been able to watch both the television screen and the actual events as they talked.

It has been pointed out that one of the basic differences between the stage and the screen is the difference between "actions" and "reactions". In the theatre the audience identifies itself with the actor, who builds up that indefinable "give-and-take" between the audience and himself by his direct actions and words. In motion pictures the "give-and-take" is built up when the audience identifies itself with "the person acted upon the screen, and not with the person acting" to quote motion picture writer Dudley Nichols.

Action vs Reaction Shots

In discussing this point in his preface to *Twenty Best Film Plays,*[2] Mr. Nichols sagely points out:

"At any emotional crisis of a film, when a character is saying something which profoundly affects another, it is to this second character that the camera instinctively roves, perhaps in close-up; and it is then that the hearts of the audience quiver and open in release, or rock with laughter or shrink with pain, leap to the screen and back again in swift-growing vibrations. The great actors of the stage are actors; of the screen, reactors.

"If anyone doubts this, let him study his own emotions when viewing a good film."

Mr. Nichols recalled that he had recently checked on this theory by experimenting with some friends after seeing Noel Coward's *In Which We Serve.* All were most profoundly moved by reactions rather than action. Particularly effective, he found, were such scenes as the shot of a woman as she receives word that her husband has ben killed: and the face of an officer as he learns that his wife is dead. He is writing a letter to his wife when the news is brought to him by the radio operator, and the reaction shot is continued beyond the usual facial expression, for he goes on deck, looks over the rail, and lets the unfinished letter flutter down into the water—extending reaction into action.

Another highly moving scene was the final one in which the captain says goodbye to what is left of his crew. We saw the faces of the men as they came forward to shake hands, and we heard their tired voices. This appeared to be straightforward action, whereas Mr. Coward actually staged it as a reaction shot. It showed the reaction of the men to their harrowing experience, all summed up in their weary faces and laconic speech.

Although Mr. Nichols did not note the fact, it is interesting to observe that these most effective scenes were all close-ups or medium close-ups. Obviously, to show clearly the reaction of an actor to a given situation, the scene must be a close-up. Now, the most *effective shots of early television have all been close-ups.* Undoubtedly this was due, in part, to the fact that early television receivers gave small-size, imperfect pictures in which small figures did not stand out

clearly. However, this may also have been due to television's qualities of intimacy and effective transference of personality.

Television directors should find it profitable to investigate thoroughly the possibilities of the close-up. The close-up may continue to be our most effective shot, and perhaps we shall find ourselves learning a great deal more about its potentialities.

The fact that "live" television programs require a continuous and sustained performance, with no retakes and no leisurely editing over a period of weeks, is not necessarily a handicap. On the contrary, it will undoubtedly prove to be a most important factor in making a new art form out of television.

It is physically impossible to imitate motion picture technique beyond a certain point. This will make us develop new techniques which suit the demands of television. Cameras, lights, microphones, and studios themselves leave much to be desired. New designs are needed to provide more flexible cameras, microphones and lights.

But beyond this we must look for new kinds of program material which television can do to perfection. We must look for more expert acting than is called for in either theatre or motion pictures. The actor must be able to sustain a performance from start to finish and at the same time adapt his technique for the moving camera, now in close-up, now in long shot. And most of all we must evolve a new technique for handling the video and the audio, a technique which will be built according to the essential nature of television.

[1] See 4000 Years of Television, pp. 5-6, 108-116.

[2] Edited by John Gassner and Dudley Nichols. Crown Publishers, New York, 1943.

National Carbon 10% Price Rise

National Carbon Co. has announced an increase of approximately 10% in the price of projector carbons. Added costs in the manufacture of "National" projector carbons, the company states, have not been anywhere near balanced by the savings effected through productive efficiency.

As in the past, National Carbon Co. will continue its research and development programs in cooperation with other phases of the industry to contribute to the further advancement of motion picture technology.

PERSONNEL

E. O. Wilschke, formerly assistant to the vice-president of Altec Service Corp., has been appointed operations supervisor. He is in charge of headquarters technical operations and engineering, and will also act as the liaison between H. M. Bessey, vice-president of the organization, and the district offices.

Other Altec appointments effective immediately are: E. S. Seeley, as chief engineer, and Martin Bender, as commercial engineer. Both men have been in the engineering group of the company for many years and will report direct to Mr. Wilschke.

Mr. Seeley will carry on with the research and development in connection with field service problems. T. H. Carpenter and L. J. Patton will report to Mr. Seeley as operating supervisors. Mr. Bender will continue to handle Veterans Administration matters, public address quotations, and special equipment negotiations in the public address and similar fields.

C. S. Perkins has been appointed district manager in charge of Altec's New York District. He was manager of commercial engineering at headquarters for the past year and a half, taking over that position after three years as manager of Altec's Electronic Division at Lexington, Mass. during the war. Prior to that he was branch manager of the Boston district.

Reporting to Mr. Perkins as branch managers will be A. J. Rademacher and N. M. Wolf.

Community Chest Drive

By MARK VAN DOREN
Noted Author and Critic

I am writing this on my son's eighteenth birthday. I have other reasons for hoping that the USO and Community Chests will raise all the money they need—and more too—during the current drive, but this is a reason that everybody will understand. It seems to me very important that the boys who are now being inducted into the armed services should feel that the country continues to be interested in what they have stopped their education or their work to do.

The USO is perhaps even more necessary than it was before V-J day. Then it was difficult for any man in uniform to doubt that he was understood by all to be rendering a public service. Such a doubt is easier now. The USO will do much to remove it altogether.

The older men awaiting discharge, the troops in transit, the men on duty East and West, the wounded in the hospitals—I am not forgetting those, or ignoring their still greater claim upon our attention and affection. May they learn, as many of their forefathers did not, that republics can be grateful.

And at the end of the campaign, may all men in uniform be able to take satisfaction in the news that the Community Chests of America have been filled to overflowing for another year. There still is a Home Front. For everybody's sake, in uniform or out, it has to be kept intact. I think it will.

2000th Altec-Lansing Speaker

Installation of the Altec Lansing "Voice of the Theatre" loudspeaker systems in theatres in the U. S. has passed the 2000 mark.

PROJECTION RECTIFIER DATA

(*Continued from page 25*)

consider carefully the aforementioned points and save much unnecessary trouble by using argon tubes for which the rectifiers are designed, and *not* mercury tubes.

Appended are a few pointers on argon tubes and their use which should be helpful:

Argon Tube Characteristics

A. The most common cause of early tube failure is leakage, caused by a minute crack in either the anode or cathode glass seal. If a tube is a "leaker," when you first install it and light the filament you will note an apparent smoking of the filament inside the envelope, and shortly the filament will disintegrate until it open-circuits. Upon examination, you will note that the carbon anode is coated with a white soot and sometimes has bluish-white streaks. A tube showing this sooty deposit, whether its filament lights or not, is a "leaker" and, of course, will not function as a rectifier.

B. A "hard" tube is one that will not readily pick up its load: the filament lights but the tube will pass little or no plate current. The cause of this usually is aging, that is, the tube has been used so long that the filament has sagged into a long half-loop instead of being fairly straight, with the result that the filament is stretched out to almost double its original length.

When the coils of the filament are close together, the 2½-volt supply will heat the filament to a sufficient temperature to be highly emissive. But when the filament stretches out far enough, the area for heat dissipation is increased to such an extent that the temperature of the filament is not then high enough to be as emissive as it should be; consequently, the loss of emission prevents the tube from passing its full plate current. A tube in this condition should, of course, be replaced.

C. A flash-back tube is one in which the valve action has been destroyed due to too high a maximum inverse peak voltage being applied to the tube. This is usually caused by a surge created when breaking the load circuit, such as extinguishing the arc by opening the arc switch and leaving the a.c. cricuit alive.

In a properly designed rectifier this flash-back will not occur, due to the protective measures employed; but in those rectifiers where it does occur, there is only one remedy to stop it: leave the arc switch closed all the time or cut it out of circuit and then turn "on" and "off" the rectifier from the a.c. side, either by wiring the a.c. supply through the table switch to the a.c. input of the rectifier and connecting the d.c. directly to the lamp, or by wiring-in a remote control switch and relay in the a.c. supply.

To distinguish a tube that has flashed-back and become inoperative: you will note a hole sucked in the side of the glass envelope in some cases, or else the filament electrode will be melted down with a ball on the end and the filament partially or completely melted away.

D. Just because a bulb filament lights is no indication that it is operative, be-

Wanted...

Repair Man, experienced in mechanism and movement work to take charge of shop in large eastern theatre supply house. Write giving full details of self and experience, Box 105, International Projectionist, 19 West 44 St., New York 18, N. Y.

(Continued from preceding page)

cause it still may pass no plate current due to being either a "leaker" or a "hard" tube. Always try a tube known to be good before looking elsewhere for trouble.

E. The quantity of light emitted from a tube with its filament energized will vary in different tubes due to the differences of density of the scavenger metal deposited on the glass walls of the envelope. This should not be considered as due to a filament defect or insufficient voltage.

F. To determine whether the argon tube is rectifying—that is, whether it is passing plate current—look into the bulb with the rectifier in full operation and observe whether or not there is an arc of blue light between the filament and anode. If the tube is passing plate current, there will be a bluish arc between anode and filament very easily distinguished from the white light of the filament.

Another check-up is to remove the clip from the suspected tube while the rectifier is in full operation. If the tube is working, there will be a spark between the pinch clip and the anode terminal as they are contacted; if not working, there will be no spark.

Alaska 16-mm Show Circuit Is Serviced by Plane

Three ex-GI's have shown exceptional enterprise in the formation of a 16-mm film circuit which utilizes plane service to cover 30 towns throughout the entire Alaska Territory. Four to six film programs a month are flown from Seattle to Anchorage, Alaska, and the ex-servicemen then utilize their own planes to transport equipment and film programs over their circuit of "theatres."

The towns covered range in population from 30 to 600 and are located in isolated districts inaccessible by automobile or boat. Distances between towns range between 30 and 275 miles. Making the rounds every ten days or so, the boys give their show and simultaneously plug the next attraction.

The venture has developed so successfully that the group is laying ambitious plans for expanding their area of coverage.

Why a Xmas Seal Sale?

By *DANIEL W. JOSSELYN*

Each year at this time I. P. is glad to afford space to the National Tuberculosis Association which sponsors the sale of Christmas Seals, that mighty atom which has done so much to rid America of the dread scourge of tuberculosis. Many projectionists have benefited through the preventive and curative program made possible by the sale of Christmas Seals.

IN these fabulous days of machines faster than sound and atom bombs which destroy cities at a stroke, we sometimes forget that man's greatest achievement is his relative conquest of disease. The incredible powers of the human mind were largely absorbed when the average length of life was some 18 or 20 years, as compared with our present 65.

In this relative conquest of disease, there are two main supporting pillars of the temple of our progress. Everybody knows one of them: the discovery of the germ theory of disease. Dr. C. E. A. Winslow, Professor of Preventive Medicine, Yale University, describes the second pillar thus: The discovery of popular education as an instrument of preventive medicine by the pioneers of the tuberculosis movement has proved as far-reaching in its results as the discovery of the germ theory of disease."

And we give a name to the other main pillar—the Christmas Seal.

To understand the full significance of this discovery, we must recall the tremendous resistance to change inherent in the human race. The sad historical fact is that revolution, red and cruel and destructive, has usually been required to break the cast of ancestral habit. Even though smallpox killed some 60 million people in Europe alone in a single century, people "raved like maniacs" in opposition when offered the best and simplest of preventives—vaccination.

Tuberculosis is historically the worst of the diseases, killing an estimated quarter of the population of the globe for centuries on end. And nowhere was public belief more firmly intrenched in the inevitability of disease and death. Conquering "consumption" was as hopeless as the world was flat before Columbus: you could see it with your own eyes, all around you. Even physicians agreed.

3 Million U. S. Lives Saved

It would seem enough that the Christmas Seal gave light and heat to the crusade which changed the attitude toward tuberculosis, which has spared some 3 million priceless American lives within our memory. (Contrast poor India, with its million tuberculosis deaths a year, which had its first Seal Sale only a few years ago and only on a local basis.) But the Christmas Seal is a hundred times more important as a vehicle for health education. For the first time, here was a practical way to change the fixed beliefs of mankind.

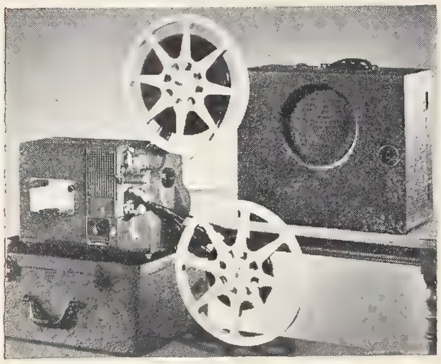
The secret? In America every year hundreds of millions of Christmas Seals go up and down and across the land. Each is more than a bullet against tuberculosis. Each is a bright ambassador of good will and education, and good, good Democracy—of, for and by the people themselves. Ten million volunteer hands, of their own goodness and understanding, join to fight a foe against which each alone is powerless.

Tuberculosis, today, though diminished by four-fifths, *still kills more Americans than all other infectious and parasitic diseases combined.* But there is this: we now are within reach of eradicating tuberculosis for all time. Every day we waste costs the people of America some 144 lives and over two million dollars! Even more Christmas Seals than ever before must now be brought to bear for the final push toward that precious freedom now within reach.

After tuberculosis? Alas, there are many foes. More Americans die of preventable causes *every year* than were killed in four years of the worst war of all time. Less than 3/10 of 1 per cent of us live to die of old age. Compared with the humble, ailing creature he now is, man can be as the plane to the ox cart. He awaits only the knowledge, which must be distributed long after tuberculosis is forgotten as the "captain of the men of death."

There must always be a Seal Sale.

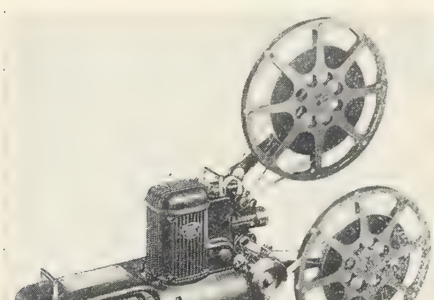
New FS-10-N Kodascope An Advanced 16-mm Equipment



FS-10-N, Kodak's top-quality, 16-mm sound Kodascope is now making its appearance in new dress—two convenient, smartly-engineered units, instead of one. Designed for versatility and carrying ease, the new cases now hold, in one, the speaker unit, 50 feet of cable on cordomatic reel, a 1600-foot take-up reel, spare projection and exciter lamps and fuse, power cord, and oiling outfit; in the other case, the projector itself plus the reel arms.

Case one, the speaker unit, weighs approximately 25 lbs. And case two, the projector, weighs approximately 47 lbs. Both cases are finished in black boar-grain Kodadur. Easy to set up and easy to use, each unit is readily packed and unpacked. The speaker unit need merely be plugged in and located near the screen. The Kodascope may be set up in the case with the cover swung open or may be removed entirely and seated atop the case, or alone on a table or other base. Everything needed for a showing, except for the screen, has a place in either the speaker or projector case.

New Ampro 'Century-10' Features Compact Quality, Economy



Making projection of 16-mm, sound-on-film movies as inexpensive as possible, while retaining all the precision features necessary for quality sound projection, is the announced purpose of the new Amprosound "Century-10." This light and compact projector with extremely simplified design provides the utmost in 16-mm sound-on-film projection where such features as still pictures, reverse operation, and the combination of silent and sound speeds are not desired.

With its constant speed a.c. motor with film speed of 24 frames per second (sound speed), the "Century-10" is adapted for use in homes, classrooms, in small auditoriums and for industry.

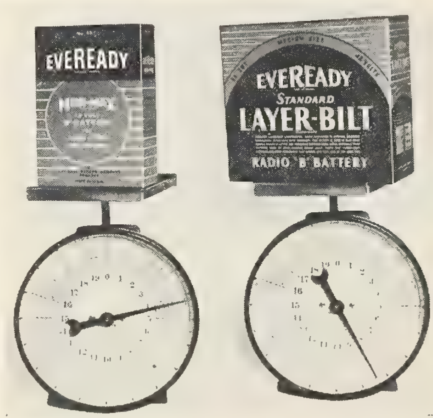
Fast automatic rewind, easy threading system, quick-centering tilting knob, and centralized panel control are a few of the convenient features. Standard prefocused lamps up to and including 1000 watts are used. Micrometric lamp adjustment aligns the lamp filament with optical system both laterally and vertically. Projector is equipped with 2-inch, $f/1.6$ coated lens, instantly replaceable by either 1, 1½, 2½, 3, 3½ or 4-inch lenses.

For Medium-Size Auditoriums

Among the features is the rotating type of sound drum which avoids sliding action between the drum and film, thus prolonging film life and maintaining high quality sound. Also provided are curved film guides before and after sound drum which eliminate weaving and "belt action," tone control, and a 12-inch p.m. dynamic speaker.

The "Century-10" operates on 60 cycles a.c. only, 105 to 125 volts, although it can be used with a converter or invertor on d.c. Complete unit includes projector, speaker, lens, lamps, 1600-ft. reel and standard accessories. Two carrying cases are also supplied, for projector and speaker. Other specs are available from Ampro Corp., 2835 No. Western Avenue, Chicago 18, Illinois.

New Eveready 'B' Battery Has ½ Size, Weight of Old Type



A new 45-volt B battery having only half the weight and size of pre-war models has been developed by "Eveready" Batteries for use with electronic industrial test equipment, portable amplifiers, radio transmitters, commercial motion picture projection machines, electronic and telephone devices, etc.

The new battery utilizes the famous "Mini-Max" battery principle originally developed to power the tiny radio sets in the proximity fuses of anti-aircraft and artillery shells, and is the most efficient storage power source ever evolved, according to battery engineers, since it employs a higher usage of space by active materials than any previous type. Round batteries have a carbon center post set in a zinc can with activating chemicals packed between. Old-style layer-built B batteries have piles of alternate zinc and carbon plates separated by layers of the chemical mix. The "Mini-Max" battery has the carbon electrode printed ink-thick, in effect, on the zinc plate—which greatly condenses the size and increases the efficiency of the battery.

TRADE UNIONS IN AMERICA

(Continued from page 23)

mind. On several occasions when the Senate took action which jeopardized the crafts, they struck, marching out of Rome in a body. They stayed on the other side of the Tiber until the Senate receded from its unacceptable position.

What took place in Rome had developed in other lands, for there are in existence proofs that the ancient craftsmen of China, Phoenicia, India, and Egypt organized craft unions. As craft organization was a natural development, craft unions were probably organized in other ancient countries, but with little if any evidence remaining to record the fact. Because the Roman craftsman was a free man, a citizen with full citizen rights, and Rome became an empire, the Roman craft unions developed to a much greater extent than in any other country. We know but little of the Chinese craft unions, for their history, if mentioned by ancient Chinese writers, has not been made available to Occidental students.

This is regrettable, for Chinese workmen claim that some of their craft unions are several thousand years old. It is known that many of their craft unions today maintain customs based upon old traditions and forms, both as to the union's attitude toward the employer and the apprentice.

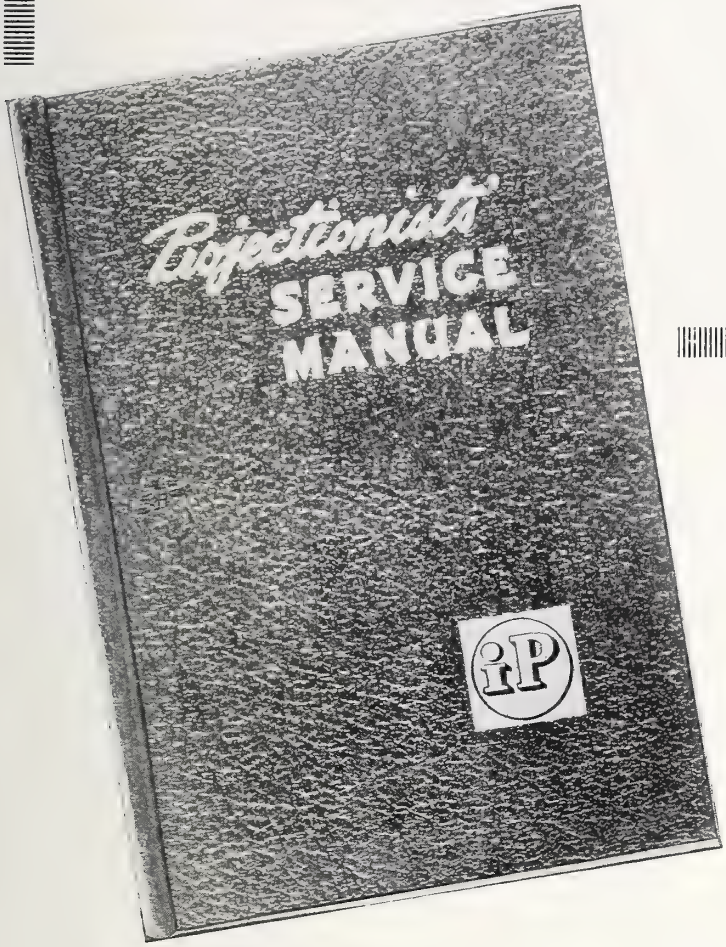
Reports come from Southern China that some unions have a dominating control of the workshop. The employer does not enter his shop without first receiving the shop committee's permission. He does not select his foreman; that is done by the union, the foreman being determined by the size of the shop, the largest having the union's president, other officers in turn filling similar positions in the smaller shops. It is the union which largely determines the terms of employment and the conditions of labor, who shall be employed and who discharged.

The employer's attitude is one of seeming satisfaction. For the wages paid, the craftsmen must deliver a stipulated amount of good work. While the employer does not hire or discharge, the union is wholly responsible for good performance and the maintenance of order and discipline. The employer is saved all effort to maintain management and adjust disputes. His concern is the securing of raw materials and the sale of his finished product.

Apprenticeship is for seven years. When an apprentice has shown sufficient aptitude he is initiated as an apprentice. Then for each succeeding year he must live for three months in the home of one of the members, the last being the home of the foreman. All this results in increasing his craft skill and acquainting him with the customs and traditions of the union into which he is finally initiated as a journeyman.

[*To be Continued*]

Guessing can be expensive



Guessing can be expensive at any time but particularly so today with the present limitations on new projection room equipment and with the uncertainties of replacements. Every projectionist should know the whys and wherefores of his equipment. He should know what to do and what not to do when the equipment fails to function properly—and how to keep the show going until the service inspector arrives at the theatre.

PROJECTIONISTS' SERVICE MANUAL is a complete, compact compilation and a valuable reference work. All items therein are grouped according to classifications and contain sound practical suggestions relating to the many projection room troubles—their causes and how to remedy them.

A copy of this valuable trouble shooter should be in every projection room for instant reference and as a trouble guide. Many I. A. local unions have ordered this book in bulk and placed a copy in each projection room. The price is right —only $3 per copy, postage prepaid. Order your copy now or ask your local union secretary about our special low-price bulk offer.

Send for it Now! *Do Not Delay*

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Gentlemen: Enclosed find $3.00 for which please send to me a copy of PROJECTIONISTS' SERVICE MANUAL, postage prepaid.

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INTERNATIONAL PROJECTIONIST

DECEMBER 1946

VOLUME 21 • NUMBER 12

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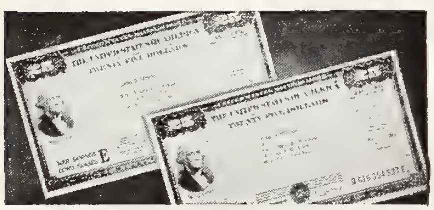
America finds a new, easy way to save

OUT of the war has come one blessing—a lesson in thrift for millions of those who never before had learned to save.

Enrolled under the Payroll Savings Plan in thousands of factories, offices, and stores, over 27 million American wage earners were purchasing "E" Bonds alone at the rate of about 6 billion dollars worth a year by the time V-J Day arrived.

With War Bond Savings automatically deducted from their wages every week, thrift was "painless" to these wage earners. At the end of the war, many who never before had bank accounts could scarcely believe the savings they held.

The moral was plain to most. Here was a new, easy way to save; one as well suited to the future as to the past. Result: Today, millions of Americans are continuing to buy, through their Payroll Savings Plan, not War Bonds, but their peacetime equivalent—*U. S. Savings Bonds.*

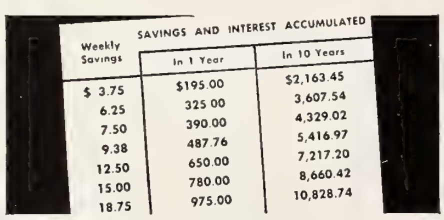


From war to peace! War Bonds are now known as U. S. Savings Bonds, bring the same high return—$25 for every $18.75 at maturity.

Out of pay—into nest eggs! A wage earner can choose his own figure, have it deducted regularly from earnings under Payroll Savings Plan.

New homes to own! Thousands of new homes, like this, will be partially paid for through Bonds wisely accumulated during the next five to ten years.

Keeping cost of living in check! Buying only needed plentiful goods and saving the money which would bid up prices of scarce goods keeps your cost of living from rising. Save *automatically—regularly.*



Weekly Savings	SAVINGS AND INTEREST ACCUMULATED In 1 Year	In 10 Years
$ 3.75	$195.00	$2,163.45
6.25	325.00	3,607.54
7.50	390.00	4,329.02
9.38	487.76	5,416.97
12.50	650.00	7,217.20
15.00	780.00	8,660.42
18.75	975.00	10,828.74

Savings chart. Plan above shows how even modest weekly savings can grow into big figures. Moral: Join your Payroll Savings Plan next payday.

SAVE THE EASY WAY...
BUY YOUR BONDS
THROUGH PAYROLL SAVINGS

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INTERNATIONAL PROJECTIONIST

With Which Is Combined PROJECTION ENGINEERING

HENRY B. SELLWOOD, *Editor*

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MONTHLY CHAT

THE turn of the year is a good time to count the blessings that have accrued to the projectionist craft within the past twelve months. The picture overall is one of widespread gains of much social significance—and we do not invite concentration upon wage increases alone. The latter are, of course, socially significant, involving the means for a fuller life and increased security. But it is fundamental in labor relations that any wage scale is in itself meaningless unless it be tied-in with *working conditions*.

Now, it is precisely on the score of working conditions that the craft has registered its greatest advance:

In Illinois projectionists' classification has been changed by the State Labor Department from "laborer" to, wondrous to behold, "skilled theatre operator." Vacations-with-pay are rapidly becoming commonplace in all work contracts. Insistence upon adequate sanitary facilities either in or very close to projection rooms has been spurred by hard-driving craft leaders who smartly enlisted the aid of civic authorities and public opinion to gain this end.

Adequate room ventilation is now the focus of a concerted craft drive; and by "adequate" is not meant a tarpaper-covered slit knocked through the side of a wall, but the circulation of outside air without creating drafts. Indeed, all smart architects now hook-in the projection room with the theatre's air-conditioning equipment.

The entrance to and egress from projection rooms via a lone, rickety ladder still is with us, sad to relate, but craft complacency on this score (unbelievably stupid though it be) is compensated for by the increased vigilance of the fire authorities who stand aghast at recent life-consuming holocausts.

More new and safer-operating equipment by twice over has been poured into the projection rooms during the past year than in any comparable period. This is a tribute to enterprising manufacturers who have energetically merchandised their wares to a point where they are fast breaking down exhibitor ignorance and indolence, as well as to the constant pushing of supply dealers.

The craft has extended its domain far beyond the confines of the theatre and studio, until today its members are found working on ships at sea, in amusement parks, at racetracks, on trains—in short, wherever intelligent management recognizes the value of professional projection work.

Yes, indeed, we have far more to be thankful for than the blessings conferred by increased wage scales. We reluctantly admit that all too many of these advantages have come to us through the efforts of all too few. Attractive as is this picture of our progress during 1946, let's all get in there and pitch to the end that the canvas will be appreciably brighter a year hence.

SMITH & BEIDLER THEATRES

EASTWOOD, WESTWOOD, PARK,
EAST AUDITORIUM AND ROYAL

PANTHEON AND PALACE

519 MAIN STREET

TELEPHONE
TAYLOR 619?

TOLEDO, 5 OHIO

September 11, 1946

Strong Electric Corporation
87 City Park Avenue
Toledo 2, Ohio

Gentlemen:

It is with particular satisfaction that we have just installed a pair of your new Strong projection arc lamps in our East Auditorium Theatre during the time that you are celebrating the production of lamp number 25,000, because one of these new lamps is number 25,000.

In 1925 we purchased the first pair of Strong lamps made. They were installed in our East Auditorium Theatre, where they have continued giving the complete satisfaction which you promised at that time.

Harry Strong told us then that no one could produce lamps that could compare with his, and he was right. Consequently, since that time we have never used any but Strong lamps and rectifiers in any of our theatres. In fact, whenever we took over a theatre with other equipment we immediately replaced it with Strong product.

We congratulate you on the celebration of the production of lamp number 25,000 and wish you continued success in your endeavors.

Yours very truly,

SMITH & BEIDLER THEATRES

By Martin G. Smith

MGS:RMF

INTERNATIONAL PROJECTIONIST

VOLUME XXI DECEMBER 1946 NUMBER 12

Video and Movies: Natural Partners[1]

By ALLEN B. DU MONT
Allen B. Du Mont Laboratories, Inc.

The accompanying article describes how these two picture-reproducing techniques can work together with growing advantages to both, rather than engaging in bitter rivalry, as is erroneously anticipated.

IT IS altogether natural that a new art should be viewed with some suspicion by the older art. But in the vast majority of cases the new art soon fits into its own well-defined groove, serving a heretofore unserved need. As often as not the new art eventually supplements, rather than replaces, the older art, thereby rounding out the over-all services to the public. So what were erroneously regarded as bitter rivals are ultimately drawn into a workable partnership as mutual advantages become increasingly apparent and real.

Your motion picture industry is a case in point. The movies that seemed such a serious threat at first to the legitimate stage have in time fitted into their own particular groove. The recorded or canned show now parallels that of the time-honored stage. There is little direct conflict. Rather, there is close cooperation today. Actors perform for the stage, and then for the movies, and back again to the stage—the better for their broadened experience. There is no longer the slightest fear of one putting the other out of business.

Tie-Up Well Under Way

History is about to repeat itself with the advent of commercialized television. However apprehensive the film industry may have been with regard to television, such doubts have given way to growing interest and a closer collaboration. It is the purpose of this paper to deal with some mutual interests that must bring movies and television still closer together as time goes on.

It must be immediately obvious that the movie-television partnership is already well under way. Film images are of excellent pictorial quality, especially when specifically selected for television reproduction. Film provides a permanent record for use at any time and in any place. Film programs can be handled with a minimum of technical personnel in the television studios, let alone the elimination of actual studio performers or again the mobile pickup unit out in the field. Just as film permits simultaneous presentation of a program in any number of theatres supplied with prints, so it provides a simple and economical means of syndicating production among any number of scattered television stations.

Also, film overcomes the problems of timing. The film can be produced when and as it is most convenient, yet the film can be shown at any time thereafter. At least half of the news and sporting events happen during the day. Yet the television audience expects to see the televised versions at night. Happily, the film recording spans that awkward gap in timing.

Still another angle: film recording permits a program to be shown again and again. Until now, with only 3 television stations sharing time in the New York metropolitan area, the audience has been viewing just the one program available on most evenings. Yet even at this early stage of commercialized television, there have been evenings when 2 and even 3 of the original television stations were on the air simultaneously with outstanding programs actually competing for audience attention.

In the future there will be 7 stations on the air each evening. The audience will obviously be missing interesting programs, just as much as is missed at a three-ring circus, if we continue the practice of a different show by each station every night. In order that a given show may be enjoyed by the greatest audience, it may be that telecasters will borrow a leaf from the movie industry and repeat their best shows, by means of film recordings. The same show might be run for 3 evenings in a row, after the manner of neighborhood movie houses. Or the recorded show might be shown again later in the evening or the following afternoon, in order to reach the maximum audience.

Film recordings are to television what the transcribed program is to broadcasting.

Film Ideal for 'Commercials'

In the case of the sponsored program, particularly the so-called "commercial" or advertising plug, film is the ideal means of insuring a uniform identity of product or company. Already many such films have been made and used to good effect in telecast advertising. The whole world of scenery is available for such shooting. Larger items, such as automobiles, trains, steamers, airplanes, and so on, can best be filmed in their natural settings. Film recordings can then be shown over and over

[1] J. Soc. Mot. Pict. Eng., September, 1946.

again with that positive uniformity of presentation so vital to good advertising. Film is to television advertising what the stereotype mat is to newspaper advertising—the foolproof reproduction.

Even in studio production, film has its vital place. Time and again a studio production has troublesome gaps or pauses that must be bridged over by some suitable pictorial action, since the television public will not tolerate a blank screen even for a few seconds. Film "shorts" help fill in such pauses.

Too, television plays have been considerably enhanced by the inclusion of movie scenes, frequently made with the same performers amid the desired outdoor scenes. For instance, if the television play calls for a bit of action—say on Fifth Avenue, or for a train, steamer, bus, or airplane—it is evident that such a scene can best be made outdoors with the same actors, rather than attempt a synthesized version in the studio. Filmed scenes also gain time for shifting from one studio scene to another.

Economically, film production presents certain advantages. Television studio problems can be frequently solved by film shooting. For one thing, studio space limitations can be overcome by having the production made in a movie studio and recorded on film. Likewise, if the studio schedule is overflowing, the production may be filmed even in the television studio itself, thereby dispensing with the lengthy rehearsals of the live-talent show. If performers are available only at certain times that do not conform with telecasting hours, the film recording again solves the problem. At any rate the entire production can be filmed and used at will, without tying up limited studio facilities.

'Live' Programs on Film

Of course the simple performance can be handled at lower cost with studio live talent and direct television pickup. This will always be the logical choice especially when a single television station must bear the entire cost. But for more elaborate productions and where several stations are participating in a syndicated program, then the movie method of production becomes increasingly more attractive. In all cases the cost comparisons should largely settle the choice of direct television pickup of film recording.

Many of the programs handled by Du Mont television stations are recorded on film as standard production routine. We have a threefold purpose in recording many of our programs:

(1) Such films provide a handy record that may be studied by our studio personnel, technicians, and again the performers, directors and writers, to improve their respective talents as time goes on.

(2) Such films are supplied to advertisers, as a permanent record of their programs.

(3) Such films serve to build up a growing library of recorded programs that can be used again either over our own stations, or syndicated to other stations.

Du Mont technicians have worked for several years on the many problems of recording television images on movie film. We have evolved a satisfactory technique, whereby television images of a repetitive rate of 30 pictures per second on the cathode-ray screen can be recorded on movie film at 24 frames per second or any other rate required. Our own recordings are made on standard 16-mm film, with sound track included, for a completely recorded television program.

Frame Speed Synchronization

The greatest problem in film recording of television programs directly off the cathode-ray tube of the television monitor is the difficulty of synchronizing the 30 frames per second speed of television to either the 16 frames per second of silent motion pictures or the 24 frames per second of standard sound film. There are two practical solutions to these problems:

(1) To record silent pictures at 15 frames per second using a synchronous motor drive on a standard camera and projecting this film at the standard speed of 16 frames; or

(2) Recording at standard sound speed of 24 frames per second using a specially constructed shutter and pull-down in a camera also driven by a synchronous motor. This will allow the film to be projected at sound speed from a standard projector.

As stated previously, television operates at 30 frames per second. If a standard motion picture camera with a shutter of approximately 204° is driven by a synchronous motor at 15 frames per second, half of the alternate 30 television frames will be recorded, the other half will be lost during the pull-down time of the camera, with the result that 15 frames per second will be recorded. In projecting a film taken by this method at the standard 16 frames per second, no particular speeding up of the subject action is noticeable.

In recording television 30 frames per second at standard 24-frame sound speed the difficulties are not so easily overcome; however, these problems are almost entirely of a mechanical nature.

Again a synchronous motor is used to drive a standard camera at 24 frames per second, but both the shutter and pull-down mechanism must be altered so that 6 television frames out of every 30 are lost during the pull-down time of the camera, resulting in a 24-frame per second recording of the 30-frame television picture.

As the film travels through the camera at sound speed, sound can be recorded in the usual ways, either on the same film using a single system or by a separate sound camera using a double system.

The motion picture business is based on sequence of runs, which is based on pricing. So far not enough money has been offered by telecasters for film to warrant any deviation from their normal arrangements. Because of this, it is evident that motion picture producers have been unwilling to supply first-run feature pictures or, for that matter, even news reels or short subjects to telecasters.

Consequently, telecasters have had to depend on entertainment films of more or less ancient vintage—films from which the movie industry has already extracted just about the last dollar of box-office revenue. Speaking for my own organization, I cannot point with particular pride to much of our film programming during the past several years.

New Source of Film Needed

Along with other pioneer telecasters, we have had to show films of five, ten, and even fifteen years ago. The pictorial quality of such ancient times is positively an imposition before the eyes of today's critical audience. Yet such ancient films can prove interesting and worth while at times. Such films have served to fill in a third to a half of our evening programs until such time as we have been able to build up our studio live-talent features.

Sooner or later, and it should be soon, telecasters must seek new sources of film. True, there is a rising proportion of

(*Continued on page* 28)

Bubbles in Lenses

By DR. K. PESTRECOV

Scientific Bureau, Bausch & Lomb Optical Company

Bubbles in optical glass have been alternately praised and damned through the years as indicative of the performance value of photographic and projection lenses and of other quality optical products. The facts anent this highly controversial topic are presented herein by an acknowledged authority.

Reading the temperature of a glass furnace with an optical pyrometer.

THE presence of bubbles in lenses is directly connected with the chemistry and procedures of glass manufacture. The basic process of optical glass manufacture consists in the melting of a mixture of several solid ingredients [fine sand of high chemical purity is usually one of them] in a pot made of a special refractory material. The pot with the mixture is heated to a very high temperature until all the ingredients combine to form a uniform transparent mass of molten glass.

The following three factors mainly contribute to the formation of bubbles in the molten glass:

1. The inclusion of air by the particles of raw materials.
2. The various reactions of the raw materials with each other, leading to gaseous end-products such as carbon dioxide.
3. The various reactions of the molten glass with the refractory material of the pot.

The bubbles formed during the melting process tend to rise to the surface, and most of them finally escape. Since, however, the fluidity of molten glass is relatively low [or, as we say, its viscosity is high] many bubbles meet serious difficulties on their way toward the surface and fail to escape from the molten mass. The smaller are the bubbles the more difficult it is for them to rise to the surface and to escape.

Bubble-Reduction Procedure

Since there are many types of optical glasses, and their viscosity in the molten state significantly varies from type to type, it is easier for one glass than for another to rid itself of bubbles: In optical glass-melting practice the removal of bubbles is aided by:

A. Exposing the molten glass to a higher temperature after the complete fusion of all the ingredients has been achieved. This is the so-called "fining" period during which the manufacturer strives to eliminate practically all the bubbles formed during the melting stage.

B. Mechanical stirring.

C. Adding some chemicals ("fining agents") which release large quantities of oxygen, thus helping the collection of small bubbles into larger ones that escape much easier.

These aids, although very effective in most cases, fail to control the amount of bubbles when a glass is so corrosive that it reacts with the pot wall during the whole manufacturing process, and when, in order to obtain some desirable properties in the finished glass, it becomes necessary to use certain ingredients which continue to react chemically and release gas up to the very moment the glass is ready for cooling ["annealing"].

Despite all the precautions and efforts taken during the manufacturing cycle, in many cases it is practically impossible to obtain large quantities of glass free from bubbles.

As in any other field of human technical endeavor, an imperfection of the product, such as bubbles in optical glass, has been taken as a challenge by the producers. This challenge is not of recent origin. During several centuries, persistent and often secret efforts have been made to meet this challenge and to produce glass free from bubbles as well as from other much more disturbing defects [inhomogeneity, coloration, insufficient transparency, etc.].

Finally, in the 19th century the glass makers were able to produce two basic types of glass [ordinary crowns and flints] of properties suitable for optical design and sufficiently free from bubbles.

It was soon discovered, however, that although these glasses could be satisfactorily used for many optical instruments, including photographic lenses of relatively low speed and narrow angular coverage, a further improvement of optical systems would be impossible unless glasses were made with characteristics radically different from those displayed by ordinary crowns and flints.

Genesis of 'Schott Glasses'

This was a new challenge to the optical industry. It was met by a young and relatively unknown man, Otto Schott, who was interested in glass making and who, in cooperation with the famous German physicist and microscope designer, Ernest Abbe, finally succeeded, after five years of difficult research and experimentation, in developing a new line of glasses, characterized by a more favorable relation between their dispersions and refractive indices than the glasses previously available. Thus the demand of optical designers was satisfied.

The new glasses were introduced on the market by a catalog published in July 1886, and became known as the "Schott glasses."

It just so happened that at that time some of the new glasses (such as dense barium crowns) especially suitable for lens design simply could not be produced without a relatively high bubble content. They did, however, permit optical designers to realize their dreams about lenses practically free from disturbing faults [lens aberrations] and to construct a series of extremely well corrected lenses—the modern anastigmats.

Bubble Count a Minor Factor

Optical manufacturers never have advocated bubbles as an asset of optical glass, although they and optical designers have always considered a certain bubble count as tolerable and unavoidable. Actually, however, when the lenses containing the new glasses appeared on the market, bubbles became "the marks of distinction" certifying the fact that a lens designer had utilized the best available material in order to produce a highly corrected lens.

Glass technology has made rapid progress since the end of the 19th century, and American glass manufacturers have succeeded in decreasing the amount of bubbles in all types of glasses, including the barium crowns, to such an extent that during the past 20 years the recognition of glass by its bubble content has almost died out.

Very recently, new container materials, nearly free of any reactivity with glass, have been introduced and tried on a small scale production. These materials will further reduce the bubble content in many types of optical glass. Furthermore, every manufacturer does not sell

all the glass as it comes from the furnaces but, in accordance with well established and generally recognized standards, selects only the better part of it to satisfy specific requirements of optical designers.

As the matter stands now, the bubble count is generally one of the minor and least troublesome factors in glass selection. Optical manufacturers have to worry about and control many other things seldom heard about and practically never recognized even by "advanced amateurs" or professional projectionists and photographers, who otherwise easily detect and wonder about a few minute bubbles in a lens.

Optical manufacturers continuously worry and struggle with such defects as striae, reams, cords, streaks, seeds, stones, cloudiness, coloration and strain in glass. They have to rigidly control their raw materials and their manufacturing processes in order to guard against all possible defects and to maintain the index and the dispersion of a given type of glass within strictly specified limits.

In finished optical elements, they have to worry about the accuracy of grinding and polishing, about accidental scratches and chips, and about fogging of polished surfaces. Recently to this list of worries was added that anent the quality of anti-reflection coating.

In their struggle against many unfavorable factors, optical manufacturers steadily have been adhering to extremely high standards. These standards have been so high that during the war the Army and the Navy became alarmed by the rules of the optical art under which manufacturers have been rejecting huge quantities of finished lenses only because of some "beauty defects." Subsequently, in order to accelerate production, optical manufacturers were instructed by the Army and the Navy to relax their "beauty standards" and to permit, within reasonable limits, any appearance defects which do not measurably affect the performance of an optical instrument.

Inspecting an unusually large piece of optical glass, preliminary to actual work.

The various specifications covering optical glass and lenses have been restudied, revised, and expanded several times during the last few years. As a typical example of a revised specification may be mentioned the joint Army-Navy Specification for Optical Glass (No. JAN-G-174, dated January 30, 1945). It has 15 pages, more than 70 numbered paragraphs and sub-paragraphs, 6 tables, and 4 sketches illustrating the government methods for glass inspection. In its text it covers a great variety of the matters pertaining to glass, including the tolerances on striae, reams, cord, seeds, stones, bubbles, light absorption, index, dispersion, color, strain, etc.

This is a basic specification covering optical glass in general. There are a number of other specifications pertaining to the use of glass in lenses and other optical instruments. All of them recognize the fact that optical glass entirely free from bubbles cannot yet be economically produced in large quantities, and that some glasses [barium crowns] are apt to have more bubbles than others.

Actual Import of Bubbles

They definitely recognize that only in some special cases is it of primary importance to secure glass practically free from bubbles. These special cases cover the glass components placed in the focal plane of an instrument—for example, recticles in eyepieces; even then the specifications consider a glass piece as being free from bubbles if, in this particular application, it does not contain bubbles exceeding 0.0004 inch in mean diameter. Otherwise, the specifications are much more liberal, and in the case of photographic filters they permit bubbles as large as 0.06 inch in diameter.

The specifications not only establish the maximum permissible size of bubbles, but they also clearly state how many bubbles can be tolerated per unit area or unit volume. For photographic optics, the specifications tolerate as many as 16 small bubbles per cubic inch of glass.

What are the effects of bubbles in a lens? It is as easy to answer this question as the question about the straw that broke the camel's back.

Every bubble acts as a small lens within the lens, and it diverts a certain portion of light from the image-forming beam. This light may suffer several reflections, refractions, and absorptions, and finally a part of it may reach the image plane of the optical instrument (photographic lens). If the bubbles are "too large" and if "too many" of them are present, they may seriously affect the performance of a lens.

This statement does not mean anything unless we determine what portion of the light may be so diverted by a bubble and by "many" bubbles. To determine this, we have to indulge in some mathematics.

Marking bubbles before cutting a piece of optical glass.

The useful light utilized by a projection or a photographic lens in the image formation is nearly proportional to the square of the lens diameter; or, to be more scientific, of the lens entrance pupil diameter. The light diverted by a bubble is proportional to the square of the bubble diameter. Hence the portion of the light diverted by a bubble from the useful light is equal to the square of the ratio of the bubble and the lens diameters.

Suppose we have a bubble of as large as a 0.04 inch diameter in a lens of one inch diameter. This bubble will divert less than 0.0016 (less than two-tenths of one per cent) of the useful light. Sixteen bubbles of 0.01 inch diameter will have the same effect. Bubbles of this size are easily visible. If we start to deal with bubbles barely visible to the naked eye, *i.e.*, with bubbles of about 0.004 inch diameter, we will need 100 such bubbles to divert the same portion (0.0016) of the useful light.

The effect is so small that an applicable Army specification permits a loss more than three times as great, and a photographer or a projectionist would not be able to detect losses many times greater.

Scientists, using suitable instrumentation, can measure even atoms and components of atoms. They would have no particular difficulty in detecting a microscopic bubble and measuring its "effect," nor in demonstrating that the air we breathe in cities contains the deadly carbon monoxide! City people continue to breathe, however, and do not drop dead. This is because the content of

(*Continued on page* 31)

The New MOTIOGRAPH AA Projector

By EMIL J. WIENKE

Chief Design Engineer, Motiograph, Inc.

The new Model AA 35-mm theatre projector is the eighth to be produced by Motiograph and comes, fittingly enough, on the golden anniversary of the founding of the company in 1896. To those who have already viewed demonstrations of the AA projector in various sections of the country the appended technical data will serve as reference material, while for those who have not yet seen this mechanism it will serve as a guide to a better understanding of the AA when finally viewed.

THE housing of the AA projector is a one-piece casting enclosing all the working parts of the mechanism, including the twin-rotor, double rear shutter. The large cast door, hinged at the front, has double windows permitting the upper and lower film loops to be readily observed during operation. A tubular extension of the main frame casting supports the lens carriage with exceptional rigidity. The drive gear compartment on the drive side of the mechanism is equipped with a dustproof cast cover firmly held in place by Allen cap screws. This construction is made possible by the fact that little access to the drive side is required, and thus harmful dirt and grit are excluded.

Most of the working parts are supported by the reinforced center frame, which is an integral part of the housing casting. It stiffens the housing and provides the rigid and stable supporting means for the film drive components and for the optical elements. The entire housing is quite large by former standards, being 15 inches high, 11 deep, and 18 long. The weight is not cumbersome, however, for all of the major castings are made of light but strong aluminum alloy. Housing corners are rounded and contours are smooth.

The AA projector is of unit construction, with all major components easily removable for inspection, cleaning or servicing without the necessity for disassembling the machine. In the drive gearing, this has been accomplished by the virtual elimination of long shafts carrying numerous gears. Power is transmitted to the various film drive points by hardened steel gears meshing smoothly into laminated bakelite gears.

The AA Gear Train

The gears run on grease-packed, double-row ball bearings which are rigidly supported by studs locked into the mechanism center frame. The gear meshes require no lubrication other than an original film of lubricant as long as they are kept clean, for experience indicates that gear wear results primarily from the lapping action caused by dirt and grit brought in by frequent hand oiling or by poorly-filtered lubrication systems.

Figure 1 shows the simple and rugged gear train of the AA projector. Power from the drive shaft at the bottom of the mechanism is transmitted by gear combinations to the ball-bearing-supported vertical shaft just back of the intermittent movement flywheel. This shaft passes through and is keyed to a wide, movable pinion which meshes with the drive pinion on the intermittent movement cam shaft, thus permitting the movement to be shifted vertically for picture framing.

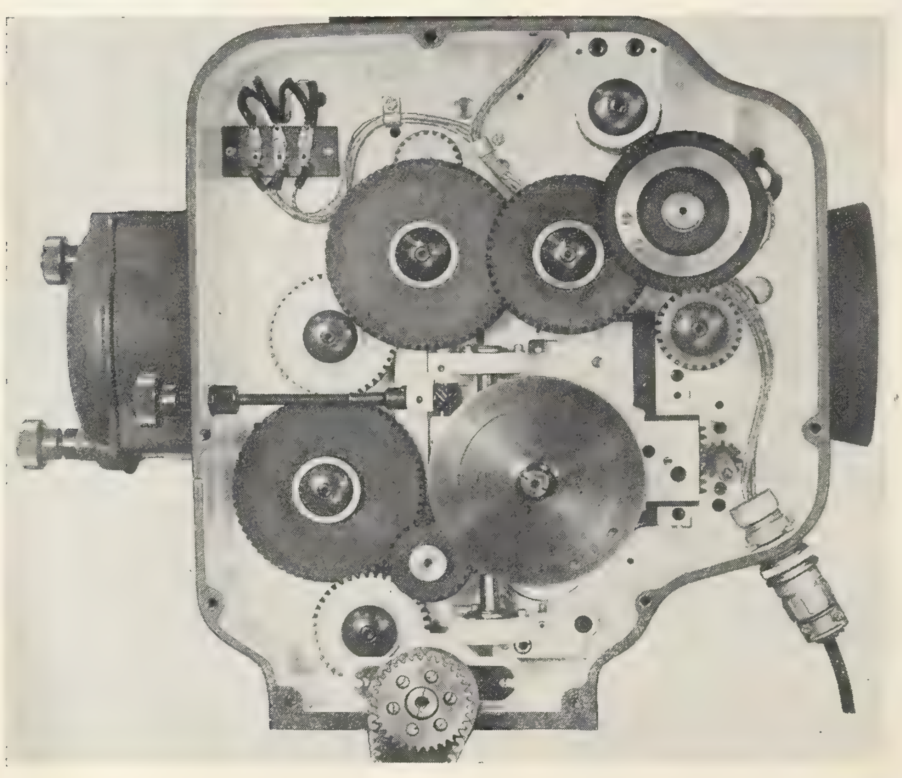
Furthermore, the position of the wide pinion with respect to its mating pinion on the movement is adjustable to provide a continuously variable shutter timing control which may be operated with the projector running. Since this control moves with the intermittent carriage, it is extended to the front of the mechanism housing by means of a flexible shaft.

Both the upper and lower feed sprockets of the projector are driven by stub shafts carrying on their drive ends suitable gears to mesh into the main gear train at the required points. The lower such shaft is just above the main drive shaft, and it also carries the drive gear for the vertical shaft. The gear on the upper is above the upper large bakelite idler gear. This idler and those to the right of it transmit power to the shafts carrying the shutter rotors and to the shaft of the blower and fire-shutter actuator.

The main drive of the AA projector is made in the form of a socket shaft into which the soundhead drive unit may be clamped in order to eliminate the need for oiling of the sound reproducer's projector drive assembly, and to provide a more rugged construction at this critical point.

Referring to Fig. 2, the tubular shaft and socket unit [item 1] runs in the sealed ball bearing [item 3] and in a similar bearing set into the center frame of the mechanism. The item 3 bearing is seated in an auxiliary rib of the main housing by easily operated clamps, so that the entire drive unit may be quickly

FIGURE 1. Motiograph AA projector mechanism, drive side, cover removed. Shutter setting knob and rod are clearly shown.



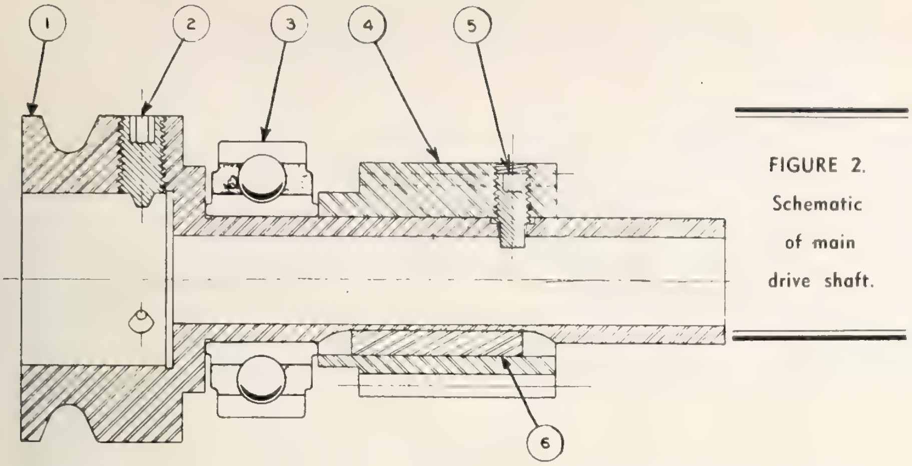


FIGURE 2. Schematic of main drive shaft.

and simply removed or replaced in operating position.

The soundhead's drive unit is locked into the socket shaft by the set screws [items 2 and 5] and the heavy-duty pinion [item 4] is fixed on the tubular shaft by the item 6 key. The large end of the shaft is provided with a belt groove for driving lower magazine takeups when the projector is operated with certain older sound reproducers having no takeup drive facilities of their own.

This drive construction eliminates the possibility of damage to projector gears due to poor alignment between the projector and soundhead. There are no long sleeve bearings to bind from inadequate lubrication, and since the drive shaft requires no additional lubrication during the long life of its sealed ball bearings, the risk of damage to soundhead optical components from excessive oiling and oil leaking is eliminated.

Charting the Film Path

The extreme roominess of the AA provides for threading simplicity. The film enters the projector from the upper magazine through a fire-trap unit having four quenching rollers running on grease-lubricated pivot bearings. Between both upper and lower rollers there is a long chute to aid in the quenching action. From the fire trap the film passes to the upper feed sprocket, upon which it is held in place by the combined action of the sprocket's pad roller and the hardened steel guide roller just above and to the right of the sprocket.

The film is thus guided smoothly over the sprocket, engaging six full perforations, and there is thus no tendency for it to jerk or slap because of uneven holdback tension from the magazine. This increases film life.

The film loops upward from the upper feed sprocket and then passes down through the gate to the intermittent sprocket, around which it passes in a clockwise direction to form the lower film loop. For best alignment and for proper engagement of the sprocket and film, the tension shoe assembly is made part of the intermittent assembly itself.

The leaving-end of the lower film loop passes over the lower feed sprocket clockwise, and the film then travels downward to the sound reproducer. Double pad rollers on this sprocket insure sufficient engagement between sprocket teeth and film perforations to block the pulsating film travel produced by the intermittent movement. The film is fed smoothly to the reproducer, thus the film motion stabilizing system does not have to cope with the irregularities produced by the intermittent action.

A distinguishing feature is that the film path below and to the right of the lower feed sprocket is completely clear of all obstructions except for the cast stripper for this sprocket. This allows plenty of space in this region for the possible eventual addition of such auxiliary equipment as double-film attachment and control-track pickup facilities.

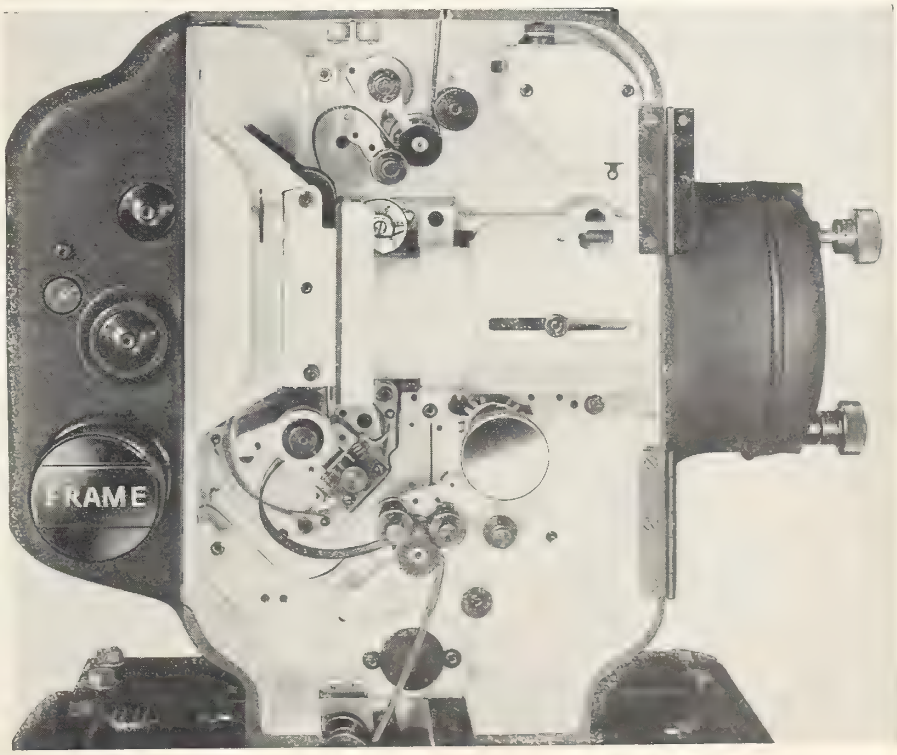
For the former, the stripper mounting boss is so located and designed as to permit the substitution of another double pad roller assembly for the stripper, so the bottom of the feed sprocket may be used to feed the separate sound track film to the sound reproducer, with the picture film going across the top of the sprocket and thence by an external chute to the picture film takeup magazine. There is likewise adequate clearance below the feed sprocket to accommodate the feed and guide rollers of a new double-film type of sound reproducer requiring no external chute and no projector modifications.

The Film Gate Assembly

The film gate of the AA, when opened forward, provides a full inch clearance between tracks and tension shoes, thus allowing really adequate finger room for threading and for routine cleaning of aperture, tracks, shoes and guide rollers [Fig. 3]. The two long film-tension shoes extend the full length of the film tracks, and for perfect alignment they are combined into a single rigid unit of hardened steel. The film contacting surfaces are ground and polished.

This unit is held to the gate assembly by studs at the top and the bottom which engage a unique gunlock mechanism within the gate body. The studs snap into operating position as they enter their locating slots in the gate body face. They

FIGURE 3. Film gate, shown closed here, opens a full inch for threading. Top knob at right is the lens lock, lower knob is for lens focus, both being on front of the head. To the right of these knobs, but not shown here, is knob for shutter setting.



Season's Greetings

International Alliance of Theatrical Stage Employes and Moving Picture Machine Operators of the United States and Canada

Affiliated with the A. F. of L.

RICHARD F. WALSH
International President

WILLIAM P. RAOUL
General Secretary-Treasurer

THOMAS J. SHEA
Assistant International President

are instantly released by pulling out a small plunger near the top of the gate body. The shoe unit is therefore removable for routine cleaning almost as easily as the film itself, and there is no chance for disturbance of either the alignment or the tension adjustment.

Operation of the film gate is by a rack-and-pinion type control device just below the lens barrel. A quarter turn of its large control knob opens the gate, and another version of the gunlock mechanism within the control shaft automatically locks the gate open as the knob is released. The gate closes and locks closed by simply pressing inward on this same knob to release the first locking device.

The gate assembly base casting has an extension at the left to support the track and aperture unit, while the gate body moves in long V-rails on steel balls. These same V-rails also support and guide the lens carriage. Obviously, all components concerned in the relationship between the film plane and the lens optical axis are part of a single major assembly which may be aligned with precision.

The degree of tension is determined by a cam-type tension control. The pressure applied to the shoe unit in the "standard" position of this control is approximately 350 grams, this value being satisfactory for films in average condition. The "low" position of the control reduces the pressure to about 225 grams to accommodate new, green film, and the "high" position increases the tension to around 675 grams to aid in flattening badly buckled older films. The control setting may be changed with the projector in operation.

The tracks and aperture of the AA are combined into one sturdily constructed unit of hardened and ground steel. This unit is drawn securely against the support casting, the engagement being between an anchoring stud on its rear surface and a long cone-point, socket-head set screw. The unit is thus very easily removable for inspection and cleaning without disturbing other components.

The lateral guiding of the film over the tracks is accomplished by the two guide roller assemblies. Each has a fixed flange, or roller half, for the sound track side of the film, and a movable flange under small spring tension for the opposite side, to accommodate films having various degrees of shrinkage without producing film buckling or failure of the guiding action.

The roller assemblies are relatively close to the aperture opening and constitute the most efficient means for eliminating film sidesway. The rollers are large in diameter so as to derive sufficient turning torque from the moving film, and are fabricated from very tough and thoroughly hardened steel alloy to resist wear. They turn freely on hardened pivot-type bearings lubricated internally through small openings in the tips from grease reservoirs within the bodies of the bearings.

EXHAUSTIVE tests were made with many different types of intermittent movements, including some which were provided with complex gearing and auxiliary cams to decrease the pull-down time. While it was finally determined that the movement of the AA should be basically of the conventional 90-degree Geneva type, it nevertheless incorporates numerous original design features.

The tension shoe assembly for holding the film in place on the sprocket is mounted directly on the movement case. Outboard ball bearings for both the sprocket, or star shaft, and for the cam shaft are provided. The movement case design and the mounting arrangements in the projector are such as to permit the entire movement to be quickly and easily removed from the operating side of the machine without disturbing any other components except the movement balance wheel.

The cam shaft is directly driven from the main projector gear train, and carries on its outboard end a balance wheel of sufficient diameter and weight to have adequate inertia to effectively equalize the pulsating torque requirements of the intermittent action.

The star shaft bearing and grease seal construction is similar to that of the cam shaft, with a threaded, locking collar to take up end and radial play in the bearings. A movable indicator cap is provided with engraved lines spaced 90 degrees. In conjunction with a single line on the locking collar, it may be set to provide a ready indication of the points where the cam drive pin just starts to engage a star slot, thus facilitating shutter timing.

A unique method is used for anchoring the sprocket to the star shaft. The shaft is hollow as far back as the sprocket, and is provided with a threaded, tapered screw engaging two steel balls which it pushes outward through holes in the shaft wall to lock into matching.

(*Continued on page 33*)

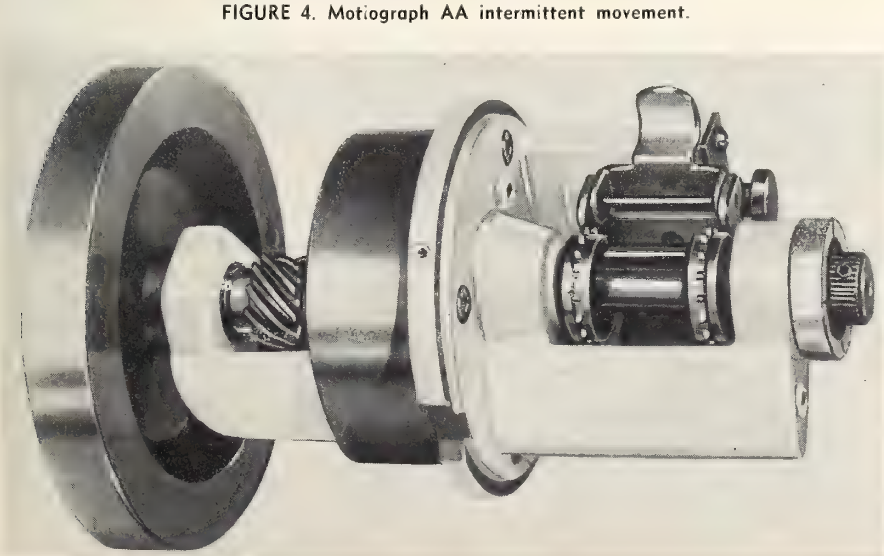
Projectionist was 'Mr. Big' in Motiograph AA Design

NO news to I.P. but serving admirably to refute those who constantly seek to minimize the importance of projectionists in purchases of theatre equipment is the statement of Motiograph that the projectionist was really MR. BIG in the overall design of the new AA projector. First consideration in all elements of design of this new mechanism was accorded projectionists' preferences in a nation-wide pre-design survey.

Virtual unanimity among projectionists was found for the following features: a one-piece housing with a reinforced center frame to prevent vibration and resulting picture unsteadiness; a film gate that would eliminate picture jump and side sway; double shutters and a perfect optical alignment through the projector; rust-proofing and hardening of all steel gears, shafts, studs, shoes, sprockets, guide rollers and intermittent parts, and silent running.

Also, a roomy white interior, illuminated threading and picture apertures, an easily-operated and wide-opening gate, self-adjusting guide rollers, elimination of manual lubrication, framing and focusing from either side, and the easy removability and replacement of tracks, shoes, apertures, lenses, sprockets, idler rollers, gears and, of course, the intermittent. A prime favorite was for a massive lens barrel to accommodate any size lens of any make or model.

FIGURE 4. Motiograph AA intermittent movement.



A 6-Phase, Full-Wave Rectifier

By MERLE H. CHAMBERLIN

Member, I. A. Local 165

Chief Projectionist, Metro-Goldwyn-Mayer Studio, Culver City, California

THE greatly extended use of metallic disc-type rectifiers during the war has resulted in important developments in this field. Particular reference is made to the outstanding progress made with magnesium-copper sulphide [M-CS] rectifiers within the heavy current field. In its present state the M-CS rectifier stack is a component of great dependability. One of the reasons for its increasing use is its ability to operate in high ambient temperatures and to withstand heavy intermittent overloads.

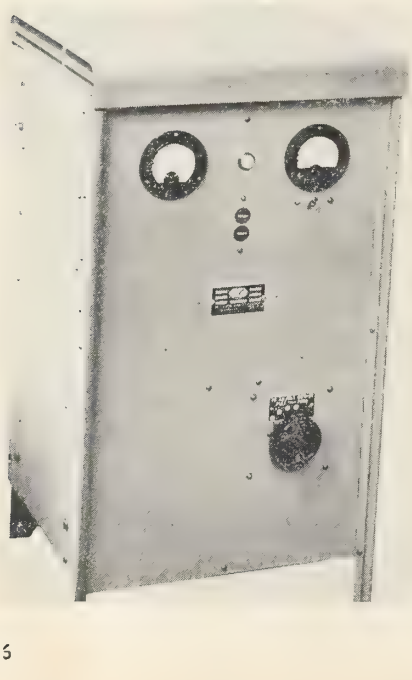
Although ordinarily operated at a temperature well below 200° F., the M-CS stacks can safely stand an operating temperature of 265° F. This compares with a maximum temperature of 180° F. for the nearest of other types of metallic disc rectifiers. Because the M-CS stacks do not need to be operated close to their maximum safe temperature limit these stacks apply themselves well to thermostatic protection by a slowly operating thermostat which does not cause nuisance interruptions from temporary overloads.

Various Types of Rectifiers

Two objections have in the past been raised against rectifiers for motion picture projection:

1. The pulsation or "ripple" has a noticeable effect on the light from the arc when projected on the screen through the intervals of the shutter.

Front view of new 6-phase, full-wave projection rectifier unit.



To analyze this let us consider first a rectifier of the half-wave type, fed from an ordinary single phase light circuit. Such a rectifier or "electric valve" only lets through one-half of each cycle of the A. C. voltage and blocks out the other half. The result is one impulse per cycle, or 60 impulses per second with 60-cycle A. C. supply. This pulsation or ripple would show up as objectionable flicker on the screen.

For this reason single-phase rectifiers for arc lamps are of the full-wave type, i.e., using *both* halves of the A. C. cycle. As there is one impulse for each half cycle this type gives 120 impulses per second on 60-cycle supply. Rectifiers which employ bulbs usually have a stabilizing choke in the D. C. circuit which tends to smooth out the ripple.

However, with single-phase supply a pronounced ripple is practically unavoidable and for this reason single-phase rectifiers are ordinarily only used where 3-phase supply is not available.

The next better step is the use of a 3-phase, half-wave rectifier fed from a 3-phase power line. Such a rectifier gives 180 impulses per second.

We now come to the commonly used type of rectifier for larger motion picture projectors, the 3-phase, full-wave [bridge type] rectifier. This give 360 impulses per second when operated on 60-cycle current.

720 Impulses Per Second

Although this type has been generally accepted in the industry and furnished by the leading manufacturers up to the present, even the 3-phase, full-wave rectifier does not deliver a perfectly flicker-free light. To overcome this a new 6-phase, full-wave rectifier has recently been developed for motion picture projection.* This is equivalent to 12-phase, half-wave rectification, such as is used in large central power stations supplying direct current to electric railroads and street cars.

With 3-phase, 60-cycle A. C. supply this rectifier delivers 720 impulses per second, and with the close overlapping of the phases thus obtained the ripple has practically disappeared and the improvement in the light is very gratifying. This represents a major step in the development of rectifiers for projection.

2. A second objection to rectifiers has been brought forth in the past. Unlike the more common electrical loads on a power system, all single-phase and 3-phase rectifiers produce in the power line certain "harmonics" which in unfavorable cases may be picked up by sound systems.

With the 6-phase, full-wave rectifier of proper design the current drawn from the power line is so nearly a pure sine wave that harmonics of a disturbing magnitude are not produced.

Switching panel for new 6-phase projection rectifier unit.

6-Phase Unit Principle

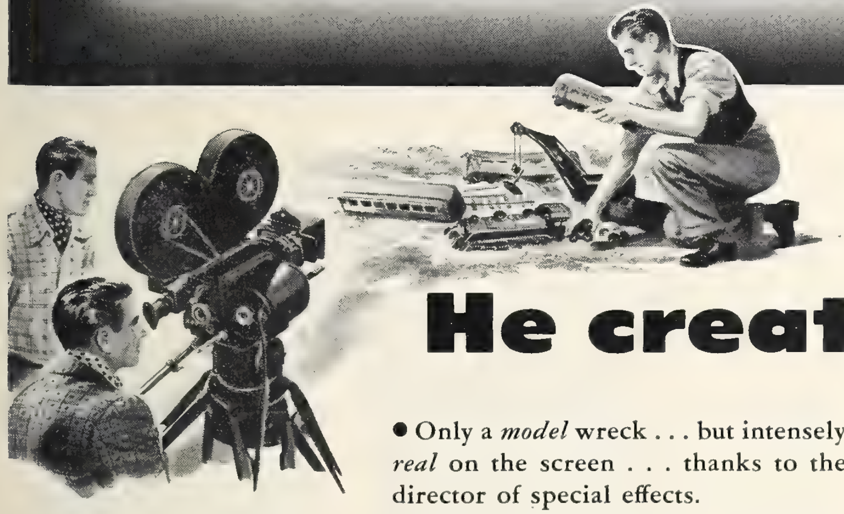
A few words to explain how 6-phase rectification is possible from a 3-phase supply line may be of interest. Without going into too many technicalities, the system consists of splitting each leg or phase of the rectifier transformer into two separate parts, then cross-connecting a part of one leg to a part of another leg in such a way that each part gives an impulse which follows by 30 electrical degrees (1/12 of a cycle of 360°) after the preceding impulse.

This is analogous to a 12-cylinder double acting combustion motor, as compared to a 6-cylinder motor, using only a very light flywheel. Like the 12-cylinder motor, the rectifier delivers a perfectly smooth flow of power.

Several of these 6-phase rectifiers were thoroughly tested by us at the M-G-M

(*Continued on page 24*)

* By the McColpin-Christie Corp., Ltd., of Los Angeles, Calif.



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Incandescent Lamps for Film Projection

By J. J. A. MANDERS

Research Laboratory, Philips Incandescent Lamp Company, Eindhoven, Holland

The second of a series of articles which cover comprehensively the requirements which have to be met in order to attain maximum efficiency with incandescent film projection lamps. Invaluable data for every professional projectionist.

PROJECTION lamps, like most electric lamps for lighting purposes, are filled with gas which helps to prevent the evaporation of the filament and allows the filament to burn at a higher temperature and attain the same lifetime. Due to the gas filling, however, it is impossible to decrease the distance between the parts of the spiral indefinitely because of the necessity of avoiding breakdown between adjacent parts.

In spite of this limitation, various means are employed to arrive as far as possible at a complete filling of the prescribed area. First, it is obvious that the lamp should be made for a low voltage. The voltage between the parts of the filament, and thus the necessary distance between those parts, then automatically become small. In addition there are other, more important arguments for the choice of a low voltage.

At a given power the current is inversely proportional to the voltage. A larger current corresponds to a shorter and thicker wire. A thicker wire may, for a given lifetime, burn at a higher temperature, since it offers a relatively smaller surface for evaporation of the tungsten. The lamps for low voltage therefore have a greater brightness for the same lifetime than those for higher voltage.

Filament-Current Requisites

In order to obtain an impression of the difference, let us compare a 110-volt/100-watt lamp and a 30-volt/100-watt lamp, both for a lifetime of 100 hours. The first has a filament 0.65 mm thick, the temperature of incandescence is 3000° K, the brightness obtained 315 candlepower per square centimeter (cp/sc); the second has a filament .155 mm thick, temperature 3100° K, brightness 855 cp/sc.

Moreover, the shorter, thicker wire has the advantage that a shorter spiral is sufficient, thus fewer sections of spiral and consequently less intermediate space between them, and in addition, due to its greater strength, it can be spiralized around a thicker mandrel, so that the width of the sections of the spiral is more advantageous compared with the spaces between. It is even possible here, using a thick mandrel, to fill up the whole filament area very satisfactorily with a single spiral without subdivision.

Apart from the heat losses through the leads, which are more important in the case of a short wire and high current [thick lead wires] and which prevent the voltage from ever being lower than about 15, a low voltage has only the disadvantage that for connection with the mains an intermediate apparatus is necessary, either a transformer or, if the purchase price be more important than the efficiency of the projector, a resistance.

Since, because of this disadvantage, many manufacturers of projectors preferred to continue using high voltages, still other means of filling the filament area more uniformly are employed. A method which is used in all kinds of projection lamps [including those for low voltage] is the introduction of a spherical mirror behind the filament. This auxiliary mirror casts a real image of the filament in such a way that the images of the spiral sections fall exactly in the spaces between the actual spiral sections. The advantage in average brightness on the film aperture to be gained in this way may amount to 50 percent.

The best uniformity will obviously be obtained when the intermediate spaces between the sections of spiral are not wider than the sections themselves, as is the case with the filament of Fig. 2 [shown in the Nov. issue]. If, however, the filament is one for a high voltage, the spiral must, on the one hand, be made thin in order for it to be strong enough with the thin weak wire which must be used; while on the other hand, the spaces between the spiral sections must be large in order to avoid breakdown. Compare such a filament for 220 volts with one for 30 volts [Fig. 3]. With such a rarefied filling of the area, as the figure shows, even the auxiliary mirror can only ensure a moderate uniformity.

Double-Spiralized Filament

A greater effect is obtained by doubly spiralizing the filament. This principle [sufficiently familiar from the incandescent lamps for ordinary lighting purpose] improves the efficiency by decreasing the transfer of heat to the gas, permits the employment of a somewhat higher temperature for the same lifetime, due to a slight decrease in the evaporation; reinforces the already mentioned black-body effect, and in our case also offers the possibility of filling the filament area about as well as if we were dealing with a low-voltage wire of the now spiralized single spiral. In this way it is possible, for example, to obtain the same average brightness with a 110-volt double spiral as with a 60-volt single spiral. Such a doubly spiralized filament is shown in Fig. 4.

Finally, the two-plane assembly is also much employed: the sections of spiral are not assembled in a single plane, but in two parallel planes in such a way that the spirals of one plane lie behind the intermediate spaces of the other [Fig. 5]. It is clear that in this way very good uniformity and a very high average brightness can be obtained, es-

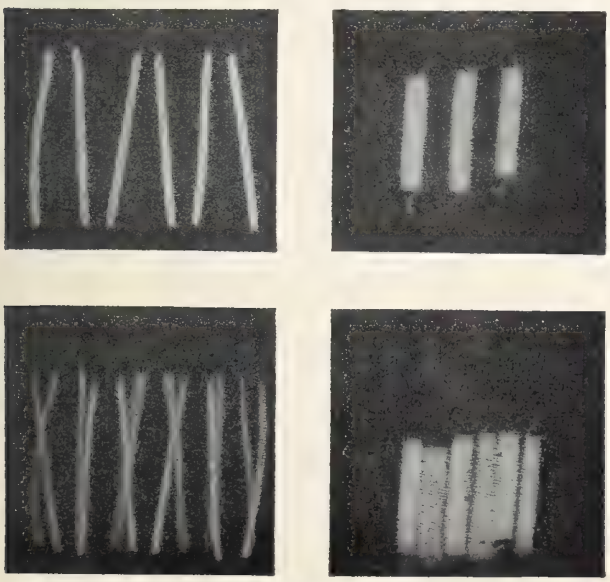


FIGURE 3.

Filaments of a 200 V narrow film lamp (left), and a 30 V narrow film lamp (right). Top row (a): The image of the filament without auxiliary mirror; bottom row (b): with auxiliary mirror. In the case of the filament for the high voltage, the filling of the area is unsatisfactory, even with the employment of the auxiliary mirror.

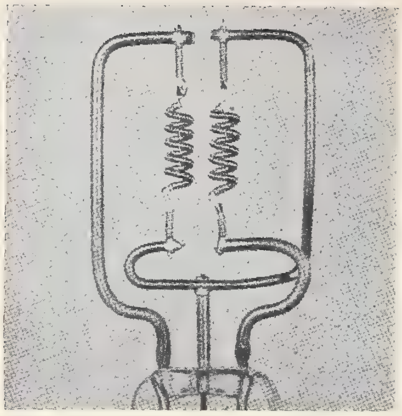


FIGURE 4. Filament of doubly spiralized wire (110 V, 250 W). Note the connections of the two spiral sections: the current flows through both in the same direction, so that there is only half the lamp voltage between each corresponding pair of points in the two sections. Because of this the two sections may be situated closer together than when the two extremities at which the current is applied and taken off are situated side by side at the same height.

pecially when an auxiliary mirror is used in addition.

These two-plane filaments are far superior to the others. In the case of one such lamp, by means of a combination of methods—two-plane assembly, low voltage and auxiliary mirror—a brightness of 4150 cp/sc has been obtained. This is certainly the highest value that has yet been attained with incandescent lamps. For the sake of comparison it may be mentioned that the spiral of an ordinary 220-volt lamp for the home has a brightness of 612 cp/sc a fluorescent tubular lamp 0.3, the carbon arc 18,000, the high-intensity arc 72,000, the water-cooled super high-pressure mercury lamp in the axis of the discharge 41,000 cp/sc.

The measures described all have the effect of promoting a greater concentration of the filament and a higher average brightness. Their effect is, however, partly cancelled by a more irregular distribution of temperature, of which they themselves are the cause. Since the temperature of the hottest part of the filament determines the lifetime, the more irregular the distribution of the temperature the lower the average temperature must be chosen for a given lifetime.

Because of this, part of the gain in brightness must be sacrificed. This effect—the unfavorable ratio between highest and average temperature—is already appreciable upon passing over from single to double spiral; it is stronger in the case of the transition from single-plane to two-plane filament; and it is further accentuated when an auxiliary mirror is added because of the fact that part of the reflected radiation falls upon the filament again and raises its temperature locally.

If the decreased lifetime be accepted, it would actually have been possible to make some gain in brightness without the mirror by raising the temperature of the filament. Independent of this controversy, however, remains the gain obtained in the projector due to the fact that with more uniform brightness the image of the filament can be focussed closer to the film aperture.

In speaking of the non-uniformity of the brightness of the filament we have

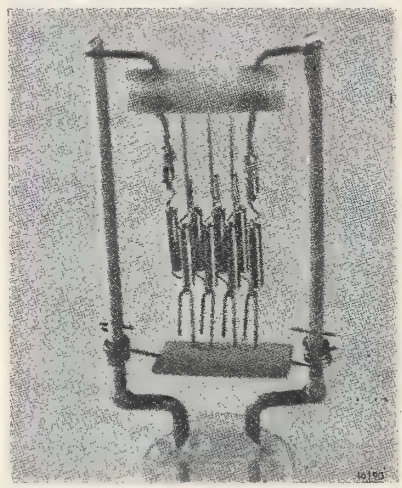
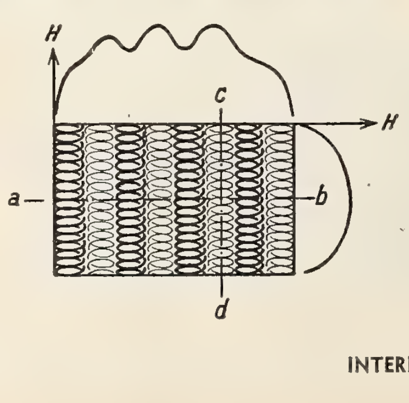


FIGURE 5. Two-plane filament, seen obliquely from above. The system of hooks which protect the spiral sections on the upper side from lateral deviations is fastened rigidly to the leads; the corresponding hooks on the lower side, on the contrary, can move up and down in a vertical direction thanks to an arrangement of two tubes which slide over the leads (so-called sag arrangement). The insulators should be noted between the hooks and the leads.

had in mind until now the more or less periodic variations which are encountered as one passes across the spiral sections and the intermediate spaces of the filament, or even along the length of a spiral over the windings. Superimposed on this is a gradual decrease in brightness from the middle to the edges of the filament, caused by the fact that the

FIGURE 6. Distribution of brightness in the filament image obtained with a two-plane filament with auxiliary mirror. Above, the distribution measured along the line *a-b;* to the right, that along *c-d*. The brightness is measured with a photocell of about half the width of the spiral image. It is plotted in arbitrary units.



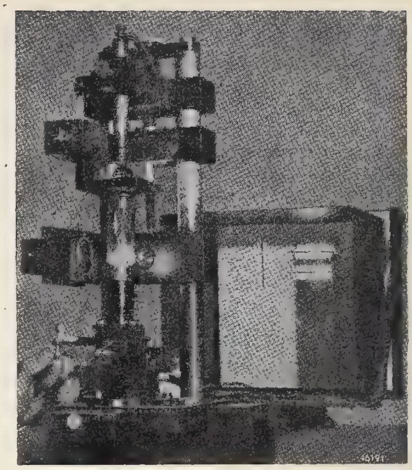


FIGURE 7. The instrument for adjusting the filament with respect to the centering socket. To the right on the screen may be seen the filament images, one of which is projected directly on the screen, and the other, seen perpendicular to it, is projected *via* a prism. By turning and shifting the lamp the images must be made to coincide with a drawing on the screen. The correct position of this drawing with respect to the lamp holder is checked from time to time with a normal lamp.

edges cool more rapidly because of the unhindered lateral radiation, [Fig. 6].

Of itself this not too rapid decrease toward the edges [which is reproduced in the illumination of the film picture and consequently also in the illumination on the screen] is not serious difficulty. It necessitates, however, a certain correction in the statement made previously about the required size of the filament: it is indeed an advantage to make the filament somewhat larger than the minimum size.

When this is done only the middle, hottest part of the filament is used, whose average brightnes may be considerably higher than the rest. And in practice this advantage is still further increased by the fact that at a given voltage a larger filament corresponds to a higher power and consequently a higher current, a thicker wire and thus a higher permissible temperature for the same lifetime.

Gas-Filling Procedure

Now a few words about the gas filling. The voltage at which, for a given distance between sections of the spiral, breakdown may happen depends upon the gas. For normal lamps a mixture of nitrogen and argon is used. The argon causes less loss of energy by the conduction of heat and therefore improves the light yield per watt, but it decreases the voltage for breakdown. Because for film projection the specific light yield is less important than a maximum concentration, these lamps are filled with pure

(*Continued on page* 36)

Bigger takes for Drive-Ins
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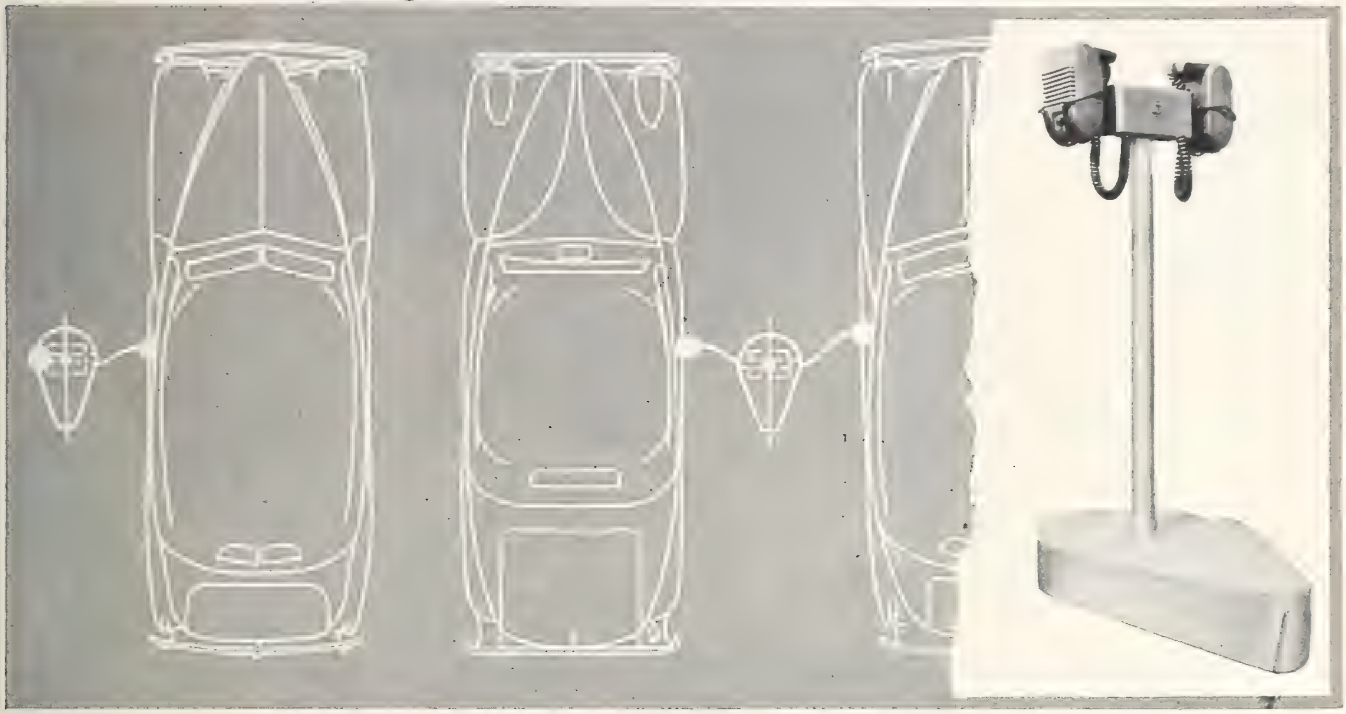

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RCA Equipment is in use in the majority of the nation's Drive-Ins. RCA Theatre Equipment Specialists, located in all key cities, are ready to help you in all phases of your project. Contact your RCA Theatre Supply Dealer, or write direct to Theatre Equipment Section, Dept. 43-L, Radio Corporation of America, Camden, N. J.

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IN THE SPOTLIGHT

By *HARRY SHERMAN*

THEATRE circuits throughout the country have adopted pension and group-life insurance plans for projectionist employes. When a projectionist has completed a certain number of years in the employ of a given circuit, he is eligible for retirement under the pension plan. His retirement income, together with his social security allotments, enable him to live comfortably for the rest of his years. It is a different story, however, for the union official who hasn't a theatre job but who devotes his entire time to union duties. When his day of retirement rolls around he has no pension plan to fall back on, and unless he has been prudent in his younger years and made provision for the proverbial "rainy day," he is very much out of luck.

In keeping with its reputation as being the forerunner of a number of progressive ideas (many of which have been adopted by other local unions), Buffalo Local 233 recently voted a pension for Bert Ryde, business agent of the local for the past 20 years, to take effect upon Ryde's retirement from office. An excellent idea, we think, and the members of Local 233 are to be commended for their thoughtfulness.

● Dan Quinones, one of the oldest members of San Antonio Projectionists' Local 407 and a member of the 25-30 Club, opened an automobile supply store in San Antonio in partnership with his son, Dan, Jr.

● William P. Covert, second vice-president of the I. A. and business agent for Toronto, Canada, Local 173, was re-elected canvassman of Variety Tent No. 28 of Toronto. For the benefit of the unenlightened, a canvassman in Variety Club circles holds a post similar to that of an executive board member of our own I. A.—one that Covert is pretty familiar with.

● Two of the delegates to the I. A. Convention in Chicago last July who sampled and enjoyed the hospitality of the Chicago local unions—Morrie Seamon, secretary, and Jimmy Murphy, business agent of Treasurers and Ticket Takers Local 751—were afforded an opportunity recently to show their appreciation of the swell treatment they and all the other delegates received. They extended a glad hand to Gene Atkinson, business manager of Chicago Local 110 and general factotum of all convention activities, when he and Mrs. Atkinson visited New York several weeks ago, and tried to make their stay in this city as pleasant as possible.

● While tinkering with his radio (being a radio ham in his spare time) Z. A. Sax, secretary of Local 159, Portland, Ore., made contact with another ham in Orlando, Fla., who, at Sax's request, made arrangements for a two-way conversation *via* amateur radio and telephone with J. B. McGee, business agent of Local 631 Orlando, Fla. The McGee and Sax families met in Chicago last summer and hit it off pretty well together. The radio contact was quite a thrill for both families.

● A memorial mass was held last month for Lieut. Leslie C. Blakeslee, Jr., member of Local 277, Bridgeport, Conn., who was killed in the battle of Tarawa, November, 1943. More than half the membership attended the services which were held at St. Charles Church at 8 o'clock Sunday morning, November 17.

● Because of pressing demands made upon his time by his official duties as business manager of Local 499, Poughkeepsie, N. Y., Ed Batey resigned as president of the Poughkeepsie Trades and Labor Council, which office he held for the past ten years. Despite stiff opposition, Batey has succeeded in retaining two-men shift operation in all theatres in his jurisdiction, with scales ranging from $65 to $70 per week, per man on a 5-day week basis.

● We stopped off at Syracuse several weeks ago on one of our periodic trips around the country and dropped in at the Novelty Theatre to visit with our good friends, Eddie Whitford and Larry Granger, members of Local 376 and projectionists at that theatre. We were amazed when we saw the cubbyhole that passed for a projection room—it couldn't be any larger than 6 square feet, barely large enough to hold two projection machines. Access to this firetrap can be gained only by climbing a ladder from the street (we learned that several men fell out of this so-called projection

KINGSTON, ONT. LOCAL 528 FETES MEMBERS AND GUESTS AT ANNUAL BANQUET
Among those attending Local 528's annual banquet last month at the Hotel Quinte, Belleville, Ont., Canada, were the following:

Front row *(left to right)*: George West, Mrs. Roy Smith, Mrs. Barrett Fralick, Blake Gordon, and Fred Bendell. Second row: Mesdames George Forhan, Sr., George Clapp, J. Iller, T. A. Mascaro, J. Anderson, W. Beach, Fred Bendell, R. Davy, Blake Gordon, the Misses Dafoe and Cummings. Back row: George Forhan, Sr., George Clapp, J. Iler, George Forhan, Jr., T. A. Mascaro, J. Carraddi, W. Austin, Roy Smith, W. Beach, R. Davy, A. Sweet, Mrs. Kerwin, W. Fawcett, Mrs. Gordon Prettie and Mr. Prettie, and Barrett Fralick.

room.) Believe it or not, but this condition exists today in one of the most successful theatres in Syracuse! In our opinion, the city officials must be asleep at the switch to permit the existence of such a booby-trap.

● Out-of-town visitors to the offices of I. P. within the past few weeks: Gene Atkinson, Chicago Local 110; Wm. Sevan, Plymouth Local 792; Rudy Peterson, Jr., Local 219, Minneapolis; Walter Diehl, Local 182, Boston; Sid Blande, Michigan City Local 570.

● Illness forced Houston S. Morton, member of Detroit Local 199, to sell his theatre equipment supply business and move to Phoenix, Arizona, where he hopes to regain his health. We're rooting for you, Mort.

● Frank E. Welsh, president of Wichita Local 414, and also president of the Kansas State Federation of Labor, plans to spend the months of January, February, and March, 1947, in Topeka, Kansas, attending the Kansas State Legislature Sessions. After the first of January, he may be contacted by his friends at the Jayhawk Hotel, Topeka, where he will make his headquarters.

● Victor A. Welman, secretary of Cleveland Local 160, is one of six men from Greater Cleveland chosen by the Supreme Council of the Ancient Accepted Scottish Rite of Freemasonry to receive the Masonic 33rd degree. This degree, the highest in Masonic circles, will be conferred on the electees, who were chosen for their outstanding service in Freemasonry, at a meeting of the Supreme Council in 1947. Vic has been a member of Meridian Lodge No. 610, Cleveland, for over a quarter of a century and has held office in practically every branch of the lodge.


Victor A. Welman

We congratulate Vic for this honor bestowed on him, and all we can add is that it couldn't have happened to a nicer guy.

● Through the efforts of Gene Atkinson, business manager of Local 110, projectionists in the state of Illinois are now classified as "skilled theatre operators," instead of the former classification of "laborers."

● The *Trade Union Courier*, a supposedly labor paper, has been denounced by G. L. Googe, A. F. of L. representative, as an "outlaw, racket publication." According to Googe, high-pressure promoters of this phony paper telephoned industrialists all over the country soliciting ads in so-called special editions. They claimed to represent the A. F. of L. in publishing a special edition which would go to over 7,500,000 members, asking from $100 to $1,000 for ads.

● Theatrical circles in Connecticut tendered a testimonial dinner last month to Earl R. Morin, withdrawal card member of Bridgeport Local 277. Due to failing health, Morin recently resigned as chief theatre inspector for the state of Connecticut, having served in that capacity for the past 22 years. The party, which was attended by over 200 people representing all branches of the industry, was a tribute to the high esteem in which Morin is held by the industry.

Hy Fine, district manager for the M. & P. circuit, was toastmaster; Commissioner of State Police Edward J. Hickey, Capt. Walter S. Stiles (retired), and Capt. Edward Urquard were the speakers of the evening. Among the I. A. men present at the dinner were Roland McLeod, James V. Fensore, John A. Martin, Bridgeport Local 277; Joe Tassinaro, Dominic Macharoli, Bridgeport Local 109; Irving Lown, Joseph Rainer, John Henry, Felix Tomanio, Danbury Local 662; George Brazil, Norwalk Local 479; Jack Kelly, Matt Kennedy, John Mongillo, New Haven Local 273; John J. Miller, Edward Webber, Frank Kelly, New Haven Local 74; Nick Trimboli, Felix Trimboli, Albert Maruca, Joseph Bonimo, James Caparizo, Larry Demott, Stamford Local 449. And, of course, yours truly, a friend of Morin's for many, many years.

● We had a pleasant chat with John Krebs, business agent of Local 327, Cincinnati, at the TESMA meeting in Toledo.

● Don Gaffney, business agent for Local 337, Syracuse, N. Y., has completed arrangements with the St. John's Orphanage of that city for one of his men to show 16-mm pictures once a week. A similar arrangement was made some time ago with the Masonic Home and March State Hospital for local 337 men to run 35-mm pictures. Union officials all over the country are waking up to the possibilities in the non-theatrical 16- and 35-mm projection fields.

● Steve D'Inzillo, acting business agent for New York City Local 306, has broken the ice in his efforts to restrict the showing of motion pictures on all American ships leaving these shores to I. A. men when he placed a Local 306 projectionist Victor Hilf, on the *America*, queen of the American Merchant Marine. According to the terms of the present agreement, the projectionist will give three shows a day *within an eight-hour period*, one show a day on each of the three decks—first-class, cabin, and tourist. Each show will run 1½ hours, with one-half hour preparatory time. The projectionist will receive $275 per month, plus room and board. He will take his meals in the cabin-class dining room and share a stateroom with another shipmate.


Victor Hilf

Projection equipment is being installed on all the Grace Line boats, and we understand that D'Inzillo is negotiating contracts for this line also.

25 Years Ago—December 1921

● The United States Supreme Court handed down a decision that peaceful picketing was lawful. . . . The General Executive Board was in session at its New York headquarters. . . . A fire broke out on the stage of the Rialto Theatre, New Haven, Conn, killing four people. The picture being shown at the time was "The Shiek," considered a

(*Continued on page* 37)

AT THE EARL R. MORIN TESTIMONIAL DINNER, FAIRFIELD INN, BRIDGEPORT, CONN. Left to right: Capt. Walter S. Stiles (retired); Hy Fine, district manager, M. & P. Theatres; Earl Morin; Mrs. Earl Morin, and Commissioner Edward J. Hickey.

6-PHASE PROJECTION RECTIFIER

(*Continued from page* 16)

studios. Apparent at once was the noticeable decrease in flicker. We also checked the rectifier for its ability to withstand heavy intermittent overloads and resultant increases in temperature. We operated the unit at full capacity for hours at a time and were unable to measure efficiency depreciation in any part of the machine. We tested the unit against all of our other types of current rectification used for supply to our projection lamps, and we experienced better screen results in all cases.

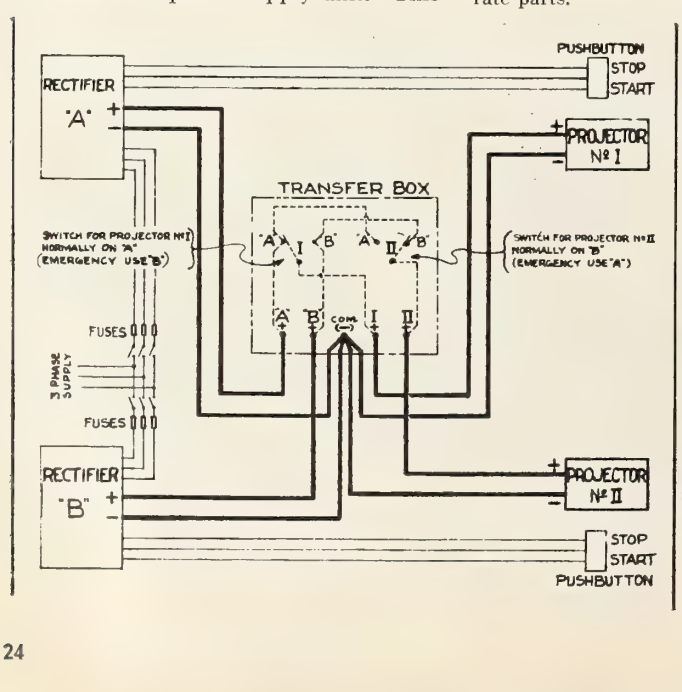
It may be of interest if the reason for the extensive tests we made were explained. We put all new equipment through very severe tests. This is done not only for our own information here at the studio but for the information of those who write in asking for data on specific types of equipment we use. In the case of the rectifiers, however, we saw in this new principle of rectification an opportunity to eliminate some of the power grief that we've had for many years.

In a plant such as ours the maintenance of a steady projection light presents a problem when you take into consideration the terrific variances of load levels on the lot electrical circuits.

These variances are occasioned by the intermittent lighting and unlighting of sets on the lot. As a result of those variances in electrical load we are continually on the lookout for better methods of flattening out the supply at our projection arcs.

Our 6-phase installations here at M-G-M studios consist of one rectifier for each lamp, remote control stop-start boxes at the machine, and an emergency transfer box which permits the operation of both lamps from one rectifier in event of failure of a power supply unit. This eliminates the possibility of having to finish a show on one machine in case of trouble.

Additional features of these 6-phase rectifiers include increased compactness, an improved remote control system, simplified switching arrangement, and a larger capacity for longer throws, the while retaining the original economy inherent in rectifiers.



Wiring diagram of 6-phase rectifiers and projectors to Type C Transfer Box.

200th RCA Electron Microscope

A major industrial achievement in the production of complex precision instruments was observed at RCA recently when the 200th RCA electron microscope, supersensitive electronic "eye", was completed and formally delivered to Northwestern University. The first commercial electron microscope was started in 1940 and took one year to complete. Each unit comprises 10,000 separate parts.

Using a beam of electrons in place of light to make possible useful magnification of invisible particles of matter up to 100,000 times, the electron microscope enables scientists and engineers to peer deep into the submicroscopic mysteries of metals, chemicals, foods and drugs, disease-causing organisms, and other substances and study details of structure and reactions never before observed.

Harry Strong's New Annual Is 'Film Family Album'

The men and women who have contributed most to the present development of the motion picture industry are featured subjects of the 1946 edition of the series of annual books published by Harry H. Strong of The Strong Electric Corp., Toledo Ohio. This volume is entitled the "Film Family Album."

With a page size of 10 x 13 inches, this superbly produced book includes full-page illustrations of each person with a short biography on the facing page. Edited with an eye to the interest of those within the industry, the biographies chiefly concern the activities of the individual as they influenced developments of screen entertainment. There are writers and dramatists, scientists and inventors, players, exhibitors, directors, and film producers and distributors.

The cover of "Film Family Album" simulates an old-fashioned photo album of the type which years ago was in evidence in the parlors of most homes.

SMPE Atlantic Coast Section Elects 1947 Officers

James Frank Jr., New York manager for National Theatre Supply, has been elected chairman of the Atlantic Coast Section of the Society of Motion Picture Engineers for 1947, succeeding Frank E. Cahill Jr., director of sound for Warner Theatres.

Other new officers of the Section for the coming year are: H. E. White of Eastman Kodak Co., secretary-treasurer; and F. J. Grignon of 20th Century-Fox, Theodore Lawrence of M-G-M International, and W. H. Rivers of Eastman Kodak, managers.

TELECASTS

All-Electronic Tele Shown by RCA

Simultaneous Transmission Supplants Sending Each Hue Separately

A REVOLUTIONARY advance in television involving the reproduction of colors entirely by electron means, was demonstrated recently by RCA. The new system transmits simultaneously the three basic colors of television—red, blue and green—and focusses them continuously on one screen for the finished picture. Technically, it supplants the twenty-year-old mechanical system of transmitting each color separately—first red, then blue and finally green—with the persistence of human vision blending the separate hues into the composite picture.

RCA emphasized, however, that it would be nearly five years before the system could be introduced to the general public, characterizing as "pure bunk" any suggestion that color video was ready for commercial presentation at this time.

New Converter Announced

A new converter alleviating the problem of set obsolescence also was announced. Attached to present receivers designed to pick up images in black-and-white, it would enable the set owner to continue to enjoy service even though the technical standards of television were changed to accommodate color. The pictures, however, would continue to be in black-and-white, a new set being necessary to receive the color.

Announcement of electronic color and the converter came as a major setback to the contentions of Columbia Broadcasting System, which for the last two years has been waging a running battle with RCA on the matter of television's future. CBS had stressed its mechanical system of color video and the possibility of black-and-white receivers becoming wholly useless.

"Mechanical color compared to electronic color is the horse and buggy compared to the railroad train or, I should say, the Stratoliner," said David Sarnoff, prexy of RCA.

Sent by Kinescope Tubes

The heart of the electronic color system consists of three kinescope tubes. The tubes receive separately the signals representing the red, blue and green colors. From the cluster of three tubes, termed the "Trinoscope," the three color images are projected optically onto the screen where they merge into the composite color picture.

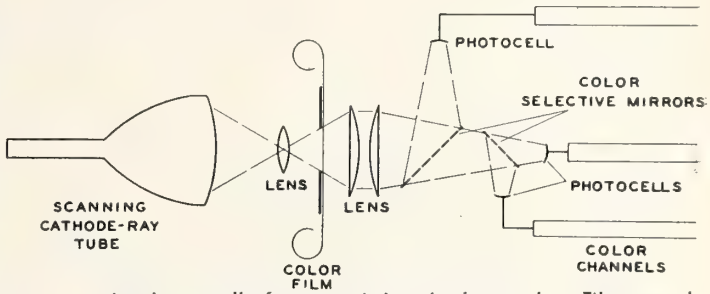
On the transmission end, a light beam from a kinescope is focused through a slide of film containing the original color picture. By a system of mirrors and photoelectric cells the colors of the picture are separated into the three components. Then the three components are transmitted continuously as separate units, though all within one channel.

Each of the three transmitted images—red, blue, and green—is 525 lines, 30 frames per second, and scanned at the same horizontal rate. This corresponds to the present commercial lower-band standards.

The color station would operate in the wave band ranging from 460 to 900 megacycles and each channel would be from 16 to 18 megacycles wide.

Under the mechanical system, a disk containing the three basic colors is revolved at high speed by means of a motor. A light behind the disk projects the colors one by one into the transmission circuit. At the receiving end, a second disk and motor are used to put the picture back into the composite whole.

COLOR FILM SCANNING UNIT

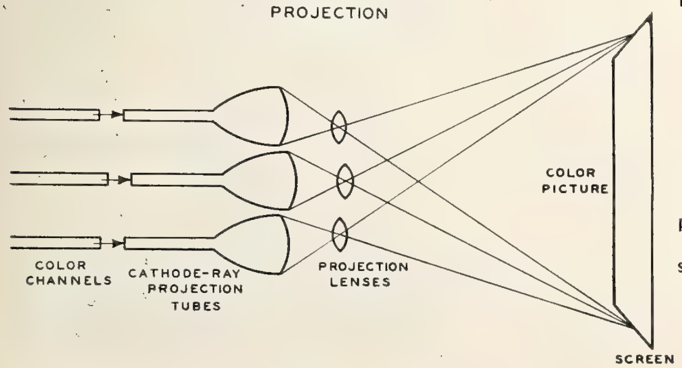


RCA color tele-film camera: A scanning beam of light from a high-voltage (30 kv) cathode-ray picture tube (with glowing screen) is focused through a color slide or film, through special lenses, onto color-selective mirrors, each reflecting a one-color image (red, blue or green) onto associated p.e. cells for transmission simultaneously. Film must be held for complete scanning.

As seen on a receiver with a screen 15 x 20 inches, the RCA images were virtually entirely free of flicker and had good brilliance. The best definition came with the slides. The films, which originally had not been scheduled to be shown for another three months, seemed free from separation of the colors when figures moved across the screen, though at times there was a reddish overcast on the images.

RCA said that it was hoped to demonstrate "live" studio scenes in electronic color by the middle of next year, outdoor action scenes by the latter part of next year, and large-screen, theatre-size pictures in 1948.

SIMULTANEOUS COLOR PICTURE PROJECTION



RCA color tele receiver: Signals from the 3-color-band channel are separately received by three 3-inch cathode-ray picture tubes (Trinoscope) and are projected optically as a composite color picture on a mirror and onto a 15" x 20" screen. Black-and-white receivers would tune in green picture signals.

Video Guys Bragging Already

Tele enthusiasts boast that more people saw the recent Army-Navy football game by video sets than saw it at the field, by probably 3 to 1. Since there were 102,000 spectators at the field, this would rate tele an audience of some 300,000.

New Novel Service Kits Now Supplied to All RCA Field Servicemen

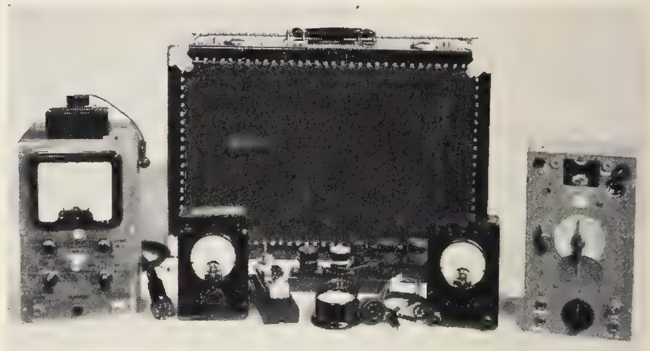
A major advance in the theatre sound service field has been made with the introduction and distribution by RCA Service Co. of a complete new test kit to all its field personnel. Substantial quantities of the new units have been shipped during the past several weeks, and all RCA field servicemen will be equipped by December 15.

Included in this kit are a specially designed battery-operated voltohmyst, a triatic signal tracer and capacitor checker, a power level meter, a d.c. ammeter and shunt, socket selectors for checking tubes, and all necessary leads for instruments. All units are contained in a reinforced fibre case which is 19" long, 7½" deep, and 14" high. The complete kit weighs only 35 pounds.

The signal tracer deserves special consideration, since it was developed and designed to fill a long-felt need for a universal tester. It will measure capacitors between 10 mmfds. and 10 mfds.. and will indicate whether the capacitor under test has low or high shunt resistance. Headphones are not needed to secure a balance of the bridge circuit: this is accomplished by an electron-ray indicator tube.

Because of the high-impedance input of the signal tracer, it can be connected directly to a signal-carrying circuit without appreciably disturbing the signal. This is a distinct advantage, since it permits checking of the electronic circuits in the theatre sound system under actual operating conditions.

Compact postwar RCA theatre service kit. Left to right, in foreground, are battery-operated Voltohmyst, power level indicator, ammeter shunt, tube socket selectors, D.C. ammeter, and triatic signal tracer and capacitor checker. Reinforced fibre carrying case in background.



In addition to this modern test kit, each field engineer is furnished with the latest Academy test film, which incorporates picture and sound excerpts from productions of the major studios. Other test films supplied include a buzz track and a 7,000-cycle recording for adjusting the optical units; a 300-cycle film for balancing photocell outputs and checking push-pull soundheads; a frequency recording from 30 cycles to 10,000 cycles for checking overall frequency response characteristics of the sound system, and overload frequency recordings for checking the power output of the amplifier.

2 Billion Industry Take!

Total admissions tax collection of $48,597,-428 for October, on September business, topped by more than $6,000,000 the previous all-time high of October, 1945.

The record "take" for October raised the fiscal year total of $166,942,935.51, compared with a corresponding figure last year of only $138,600,899.84 — a difference of $28,342,035.67.

If collections through the rest of the current fiscal year match this rate the total admissions tax "take" will just top half a billion dollars—which means an industry gate of better than two billion dollars!

New National Experimental 9-mm 'Suprex' Carbon Burns at 90 Amps., 50 Volts

JUST before the war started, the light output from the 8-mm/7-mm "Suprex" carbon trim was increased 25% by use of a new 8-mm "Suprex" positive carbon which could be burned at 70 amperes. There have since been many requests for a 9-mm positive carbon for use in existing projector lamps which were designed and built for the 8-mm positive carbon, aimed at still further increasing the light from these lamps and their optical systems.

Extensive experimental work on 9-mm positive carbons has been done by National Carbon Co. laboratories, in conjunction with arc lamp manufacturers, and there has been much speculation and many rumors as to the results obtained. These rumors are now clarified by the appended data on the use of the 9-mm carbon.

This positive carbon, with an 8-mm negative, will burn satisfactorily in an essentially coaxial trim at 85 amperes and 50 volts. It has the same maximum center brightness as the present 8-mm carbon at 70 amperes and 40 volts, with considerably more light from the crater because it is a larger light source. When an adequate optical system, lamp and power source are available in the future, a gain in light of about 25% with this new 9-mm/8-mm trim might be expected, although it will probably be necessary to cut down or dissipate heat at the film.

New Lamps, Optics Required

Since the optical system of the lamps used for 8-mm carbons was designed for the light source of that size carbon, the light increase on the projection screen from the 9-mm/8-mm combination in these lamps is only 10%, and most of this increase is on the sides and corners rather than in the center.

Furthermore, the energy released at the arc by the 9-mm/8-mm trim at 85 amperes and 50 volts is 4.25 kw, compared with 2.8 kw for the 8-mm/7-mm trim at 70 amperes and 40 volts, and 2.5 kw for the 8-mm/7-mm trim at 65 amperes and 38 volts. Since most of the existing lamps are designed for this 65-ampere operation with the ventilation calculated accordingly, this 70% increase in the dissipated energy at the arc results in temperatures for which present lamp equipment is deemed unsuitable.

Also, present power sources designed for operating conditions of no more than 70 amperes and 40 volts might not produce sufficient power or withstand the load necessary for the 85-ampere/50-volt arc operation.

It does not seem desirable to risk damage to both lamp and power source for only a possible 10% increase in light with present equipment, and therefore *these carbons are not recommended for use in existing equipment.*

VIDEO AND THE MOVIES

(*Continued from page 6*)

studio live-talent material now in the making, but as telecast programs are lengthened to cover afternoons as well as evenings, we may be obliged to use an increasing amount of film entertainment.

The time is coming when television should have suitable film productions of its own. Such films should be geared to television requirements — technically as well as in subject matter. Already some telecasters have covered news events with their own cameramen. Such presentations have been well received by the television audience.

Much of this news reporting has been handled with 16-mm camera equipment, and it is important to point out that this smaller film televises about on a par with the 35-mm size. Thus the telecaster can work with the convenient and economical 16-mm equipment and film, which is especially significant for the smaller television station covering local news and sports.

So far we have considered the contributions past, present, and future of movies' to the up-and-coming art of television. But this movie-television collaboration is definitely a two-way proposition. In time television will contribute much to movie technique, as well as to movie economics.

Television Direct to Theatre?

Among the earliest television contributions to the motion picture art is the Du Mont film-recording method of presenting televised events in theatres. Our engineers have long worked on the problems of projecting bright television images of adequate detail on full-sized theater screens. Today we have high-brilliancy tubes and large aperture lenses for approximating these results. Nevertheless, we have developed another method which offers more satisfactory results by way of recording the television images on film and then projecting the film in the conventional manner.

The Du Mont equipment for this purpose—covered by the broad basic U. S. Patent No. 2,373,114—includes a high-brilliancy cathode-ray tube carrying the television image. The image is photographed on movie film, along with the sound track. The film is then automatically developed, fixed, rinsed, and dried, ready for conventional projection in a matter of minutes. The film can be cut and spliced, titled and edited, as necessary. The televised news event, taken off the air or coaxial cable, is on the screen almost, as soon as it happens, so that it still qualifies as seeing-while-happening reporting. Yet the film makes possible the showing of the event as often as may be desired, which is a prime requisite of the theatre or movie house.

The bulk of the revenue for big boxing bouts of the near future will no doubt

come from theatre television. Likewise, with other sporting events. *For the box-office is still the logical place to collect for such features,* and this television-filmed technique provides *the practical means of multiplying the paying audience* to untold proportions. This service is not to be confused with usual news reels, since it presents the event in the matter of minutes as against hours for the usual movie version. And a televised event—seen as it happens—must always have fresher and greater box-office appeal. Meanwhile, the televised event will also be available to news reels for usual distribution.

The possibilities of television-filming are simply unpredictable. Even at this early date the television studio and its control room may well be the envy of the movie producers. In television we have a plurality of cameras on the studio floor, each transferring its pickup instantly to a respective monitor screen in the control room. The production director has before him the respective pickups of all cameras. By means of the intercommunicating sysem, with earphones worn by the cameramen, he can instruct any cameraman as to desired shots.

Any single pickup can be selected and transferred to the transmitter for placement on the screens of the telesets of the audience. More than that, any combination of scenes can be used by corresponding switching. Also, there are electronic faders, lap dissolves, and other effects largely duplicating movie camera technique. The control-room operators can obtain simple or intricate montage effects by electronic manipulations of the pickups of two or more cameras, while each component of such a montage is under complete and immediate control.

The Electronic View-Finder

As an interim step in television-filming, the remote electronic view finder idea may interest movie producers. The usual film cameras are still used in the conventional manner, but attached to such cameras is a miniature television camera which transmits the view finder image to a screen before the director. Thus the director has before him the exact scene for which any camera is set at that given moment. The director can phone the cameraman and give instructions, while viewing the new setup of the camera as such instructions are followed.

When the scene is properly set in the electronic view finder, the order to "roll" the camera follows. What such co-ordination could mean to the director of gigantic spectacles, covered by many cameras in scattered locations, is feft to your imagination.

As time goes on the pictorial quality of televised images will steadily improve until it is on a par with motion picture

film. Television-film recording will then be fully feasible, with television cameras transferring their images to a central control room where the director and his technicians will select the choicest scenes and actions for recording.

Another fascinating television-filming possibility is found in the growing sensitivity of the television cameras. The new image-Orthicon tube, with a sensitivity 100 times greater than that of previous television tubes, now picks up scenes in moonlight, by candlelight, and in any kind of weather. Already we have reached a point in television camera technique whereby poorly lighted scenes that cannot be filmed directly on film emulsions can now be recorded through the intermediary of television. An entirely new world of movie possibilities is opened up by this supersensitive television pickup.

Television likewise finds its place in the merchandising field. In addition to its use in the theater, home, and school, television is entering the department store for the purpose of reaching more people in more departments with the offerings of other departments. Telesets are located at strategic points throughout the large department store.

A center studio is set up, with the necessary cameras and associated equipment. Before the cameras may be placed certain goods to be displayed, or models to fashion the latest garments, or a demonstrator with something to demonstrate. Instantly the image and the voice are made available at strategic points throughout the store, thereby overcoming to a large degree the penalty that has been paid heretofore for magnitude.

In place of the live pickup, suitable merchandising films may be used. Or the given live-talent pickups may be recorded on films for repetition. Again television and film work hand-in-hand.

Movies and television are natural patterns. One supplements the other. Movies are the permanent record. Television is the more advanced way of getting the picture. Television owes much to movies up to this time. But from here on movies will be receiving increasing benefits from the rapidly refining television technique.

I. A. Elections

LOCAL 150, LOS ANGELES, CALIF.

Wallace G. Crowley, *pres.;* Harold Angel, *vice-pres.;* Charles Vencill, *sec.-treas.;* George Schaffer, *bus. mgr.;* Paul Mahoney, *asst. bus. mgr.;* Ralph Moelle, *sgt.-at-arms;* Frank McBryde, *guide;* Clint Bolinger, Virgil Crowell, *exam. board;* Magnus Neilsen, Clay Blanchett, Clair Piper, *exec. board;* Henry Kearney, Leo Stockwell, *trustees.*

LOCAL 414, WICHITA, KANS.

Frank E. Welsh, *pres.;* Emmett Jeffress, *vice-pres.;* H. I. Phillips, *sec.;* Wm. A. Lee, *bus. rep.;* Lee Kickle, *treas.;* Artie Murphy, *sgt.-at-arms.*

LOCAL 586, HASTINGS, COLUMBUS, GRAND ISLAND, NEBR.

W. E. Snyder, *pres.;* F. L. Kerwood, *vice-pres.;* C. Krieger, *sec.;* E. O. Hart, *fin-sec.;* L. Christofferson, *treas.;* Leo Tews, *bus. rep.;* R. O. Berger, *exec. board.*

BUBBLES IN LENSES

(*Continued from page 10*)

carbon monoxide is practically negligible.

Millions of amateurs and many thousands of professionals have been using "lenses with bubbles" without noticing any adverse effects. Since the bubble content in optical glass is continuously going down, they will hardly ever have a chance, even under some very special condition, to observe a "bubble effect."

What should a photographer or a projectionist do about bubbles in a lens? From what was previously said, the answer is obvious: he should do nothing, if his primary interest lies in the lens performance and not in conducting some superficial observations.

The fact that a lens contains bubbles or is free from them has no basic significance. Of fundamental importance is whether the lens is precision-made, and whether the glasses used in it are insufficiently free from inhomogeneity which, although concealed, may have disastrous effects.

Superficial Inspection Valueless

All these factors do not reveal themselves under superficial observations. An experienced optical designer or an optical engineer can, after a careful examination of a lens, say a few words about its design, about its good or inferior workmanship, and about some defects in glass which remain hidden from untrained eyes. If the lens is of an old make, he may even take a chance on guessing the type of glass by its bubble content. He will in no case, however, condemn a lens only because of a few bubbles in its components or because of some other appearance defects unless they are so pronounced that it becomes obvious that the lens was not made in accordance with the generally accepted rules of the optical art.

For the lens designer, as well as for the lens user, the value of a lens is determined by its performance. The designer rarely worries about its bubble content because he knows that most of them can be produced *sufficiently* free from bubbles to satisfy his critical requirements, and he would not handicap himself by limiting the choice only to "bubble-free" glasses. This is because his primary task is to produce a well-performing lens, using the best suitable formulas and glasses, and not to produce a bubble-free lens, even if by doing so he cannot secure its good performance.

There are some cheap glasses which can be easily produced free from bubbles but are nevertheless unsuitable for most purposes of the modern optical design. The lens designer is not disturbed by this fact. On the other hand, if a glass be produced tomorrow of some unusually favorable optical characteristics and a high bubble content, the designer would not hesitate to use it in order to improve his formulas and to assure superior performance. Thus it may happen again that bubbles in glass would become the "marks of distinction" of some ultra-modern anastigmats.

The user is entirely justified in his desire to get the best performing lens

TESMA-TESDA Trade Show Huge Success

THE all-time, all-high, all-champ theatrical equipment exhibition was provided at the Trade Show sponsored jointly by TESMA (manufacturers) and TESDA (supply dealers) at Toledo, Ohio, Nov. 8-11 inclusive. More than 500 visitors attended the show, with a full complement of manufacturers and dealers on hand to make it worth while. The equipment was there on display, the manufacturers' representatives worked long and hard at their display booths, and the visitors gave every evidence of keen interest and deep appreciation.

Particularly surprising was the character of the visiting crowd. Every branch of endeavor in the manufacturing and exhibition field was represented, and projectionists present numbered more than 75 from practically every section of the country.

Nobody had cause to feel cheated in terms of time, effort and money for having attended this swell show, and least of all the projectionists who have been quite critical of such gatherings in the past.

Those Who Did the Job

Everybody connected with the enterprise deserves a bow for making it the huge success it was, but top honors must go to Roy Boomer, secretary-treasurer, and Oscar Neu, president, of TESMA; Ray G. Colvin, president of TESDA; Harold Wendt, of the Wendt Advertising Agency, and last but certainly by no means least Harry Strong, president of Strong Electric Corp.

Harry Strong's top achievement, among many, as local host was to pick up 450-odd conventionites, transport them to a roadhouse across the Michigan line, feed them and entertain them royally at a party that was tops for any party ever staged in the industry.

Plans are already in the making for an even greater effort on next year's Trade Show in terms of increased manufacturer and dealer participation. If the great show staged this year is any indication of that for 1947, the event will be a "must" for everybody who wishes to keep abreast of the score in the equipment field.

It was a fine job boys, and everybody who helped to make it so deserves credit which could not possibly be extended by even several pages of type herein.

BUBBLES IN LENSES

(Continued from preceding page)

that can be obtained within a given price range. He may, however, choose the "worst buy" by paying unwarranted attention to the freedom from bubbles. Let glass, lens, and camera manufacturers worry about bubbles as well as striae, reams, cords, stones, seeds, absorption, coloration, index, dispersion, strain, polishing scratches, stripes, spots, etc.

Reputable manufacturers, more than anybody else, are concerned about all the visible and invisible imperfections in glass because they have to meet the strict standards formulated by commercial and government organizations. Every well-established manufacturer of optical goods has at his disposal the most powerful inspection instruments which he uses to ascertain good performance of his products and to satisfy his customers.

He is especially interested in eliminating such defects as bubbles which easily attract the customer's attention. If he still comes on the market with optics containing bubbles, it is because he cannot produce economically otherwise, and because he knows that intelligent and reliable customers will judge his product by its actual performance and not by some arbitrary notions about the significance of bubbles in glass.

Pity the Poor Producers

Consolidated *net* profit of RKO Corp. and subsidiary companies for the first nine months of 1946 showed an increase of $6 million over the corresponding period of 1945, while the consolidated net for the 3rd quarter of current year more than doubled the net for the corresponding quarter of 1945.

What was the *net* profit for the nine months? Just a mere $9,963,906. All that's needed now is a few more speeches about the producers going broke, following which the prods will take over the U. S. Mint.

MOTIOGRAPH AA PROJECTOR

(*Continued from page* 15)

but smaller, holes in the sprocket body sleeve.

Lateral and angular positioning of the sprocket on the shaft is provided, however, by an aligning stud which engages an accurately machined slot in the sprocket body. The tapered screw cannot be backed out far enough to drop the balls from their sockets because of the presence of the tubular threaded insert in the star shaft which mounts the locking collar.

Fast Removal, Replacement

For very rapid removal of the sprocket for inspection, cleaning, reversal or replacement, it is merely necessary to back out the tapered screw, remove the locking collar, take off the outboard bearing by removing the single fastening screw which holds it on its locating dowels, release the stripper anchoring set screw, at the bottom of the same hole, and slip out the stripper to release the sprocket. The whole operation can be performed in less than two minutes, and since there is no need for removing the movement from the projector, there is no chance for disturbing the shutter timing.

In the tension shoe assembly, the shoe proper is fabricated from tough alloy steel and thoroughly hardened, ground and polished. It is tensioned by a single center spring and is thus self-aligning and self-equalizing with respect to pressure on its two runners. The shoe is held to its spring-tensioned support plunger by guide bars.

The assembly is opened by pushing the finger grips away from the sprocket until the latch ball is pushed into the plunger groove by the spring. It is released and automatically closes by pressing the release button, which pushes the latch ball out of the groove and allows the plunger to return to its closed position.

The inner shifting frame which mounts the intermittent movement is moved vertically in V-rails for picture framing. The movement is held in place by the clamps tensioned by springs so that they will stay in their open positions. The adjustable stop, bearing against the movement rear-bearing bracket, permits the movement to be rotated in its seat to produce the proper mesh between its drive pinion and the wide pinion which is keyed to the vertical shaft.

The wide pinion is mounted on the moveable bracket which in turn is supported by the threaded shaft. The flexible shaft from the shutter timing control *via* small right-angle gears turns the threaded shaft to move the wide pinion upward or downward and thus vary the

angular relationship between the movement action and the shutter operation for fine shutter timing.

The rack by which the shifting frame is moved for framing is tensioned outward in its guides by springs to take up all backlash between it and its associated pinion mounted on the through shaft carrying the large framing control knobs on either side of the projector housing. The tension springs obviously also exert braking pressure between the shifting frame and the left V-rail so as to prevent any tendency of the frame to creep in either direction, while still allowing for easy operation of the framing control.

The control on the operating side is provided with an indicator dial to enable setting the framing adjustment in the middle of its 1¼-inch frame range prior to threading. This dial also permits instant decision as to which way to turn the control to correct misframes during operation without shifting the picture all the way up and down the screen.

Double Rear Shutter Assembly

The twin-rotor double rear shutter features an entirely new design. For best picture definition and maximum light efficiency, the shutter rotors should cut the light beam simultaneously from top and bottom as close as possible to the aperture and preferably in approximately the same vertical plane so as to preserve symmetry in the opening and closing actions.

These objectives have been attained in the AA design by having the shutter consist of two concentrically-mounted cylindrical rotors turning in opposite directions transversely to the light beam immediately in front of the aperture. The master, or cutting, blades of the rotors cut the light beam in planes less than ⅛ inch apart and only 2 inches from the aperture. As the light is thus symmetrically interrupted at its narrowest possible diameter, the opening and closing action are unusually rapid and smooth, with corresponding improvement in both picture definition and projector light efficiency.

The rotors turn in ball bearings, and have narrow balancing blades opposite the working blades and integral cooling fins to circulate cool air over their bearings and the aperture. They are individually balanced dynamically so that the complete shutter operates with virtually no vibration. This is partly due to the fact that the shutter driving torque is adequately isolated from the pulsating torque at the intermittent movement drive points by the latter's relatively heavy balance wheel, and by the cushioning effect of the intervening gear meshes.

Due to the basically high light efficiency of the shutter design, it has been possible to make the working blades of the rotors of such angular width as to allow for a very liberal margin of safety in the matter of travel-ghost effects due to lost motion between the shutter and intermittent.

Clearance has been allowed for the cone of light from the proposed $f/2$ arc lamp optical systems using 16-inch reflectors.

Fire Shutter, Ventilating System

Centrifugal actuators for fire shutters should turn at relatively high speeds for positive operation without excessive dimension. The AA design combines the fire shutter actuator with a blower of really adequate capacity to properly cool the shutter and aperture.

The combination blower and actuator is located in an enclosure above the shutter compartment. It draws air inward through vents in the housing under the shutter, under the track and aperture unit, and upward over the shutter and across the aperture. The heated air is exhausted through a vent grill at the top of the mechanism.

The shutter and aperture are thus located within a forced draft "chute" with the light-opening being closed off to air currents by the currents produced by the rotating shutter. Although air flow in the chute is considerable, the air is not forced into or drawn out of the arc lamp, thus no harmful carbon dust and arc vapors are drawn into the projector.

The lens carriage will accommodate any make or model and virtually any focal length projection lens by using suitable cylindrical adapter sleeves. It includes several design features to facilitate accurate focusing and easy removal of the lens for inspection and cleaning. Backlash in the focusing control is permanently prevented by the spring tensioned soft slug bearing on the threads.

The lens is supported within the barrel by three accurately machined full-length pads. Two of these are solid projections from the barrel casting—the one nearest the lens lock control being a separate, machined casting having a lug on its rear surface which ex-

tends through a slot in the barrel casting to engage the threaded shaft of the lock control. This pad, or clamp, has a slight taper on the surfaces which contact the guide slot in the barrel, and therefore, as it is drawn forward by the lock control, moves inward to clamp the lens rigidly in place. It cannot throw the lens out of alignment with the barrel, since it is the third member of a three-point support system where the alignment is determined by the other two fixed members.

There is an adjustable stop for longitudinal positioning of the lens within the barrel, and an extractor unit for shorter lenses. Lenses thus may be easily removed and replaced without disturbing the focus setting.

Lighting, Wiring, Changeover

The AA projector is provided with two auxiliary interior lights: a lamp for general interior illumination with an on-off toggle switch at the lower edge of the housing, the flat contour of which mounts a glass shield to protect the lamp and as an extra safeguard in the event of accidental lamp breakage. The second light is within the shutter enclosure below the secondary framing aperture, which is slightly above and to the rear of the upper guide rollers.

The framing aperture has a glass shield to prevent the entrance of dirt and is equipped with two registry pins. The linear relationship between these pins, the secondary aperture, and the actual picture aperture is such that when the film is on the pins and is properly framed in the secondary aperture, it is likewise correctly framed at the picture aperture. There is thus no need to engage in awkward contortions to see the picture aperture during film threading, and framing can be checked at any time prior to starting the machine merely by bending the upper film loop back over the framing aperture.

Both lights are controlled by the toggle switch previously mentioned. They are normally equipped with 115-volt lamps, but the sockets also accommodate certain low-voltage lamps where local regulations prohibit the use of standard voltage lamps within the projector.

The changeover device is of generally standard construction, although the special model for the AA projector[1] includes thermostatic protection for the operating coils and makes use of the projector's internal changeover wiring as well as its built-in changeover shutter, which operates in an extra set of guides before the automatic fire shutter in the light path.

The Motiograph AA, while presenting many entirely new features, is nevertheless designed so that it affords complete interchangeability with older equipments. The base layout, the drive-point location, speed and direction of rotation, and the magazine mounting facilities are similar to those of other currently available machines. It may therefore be used with any modern sound reproducer and with any make of uper magazine without changing the existent projector drive and without using mechanism mounting plates or special adapters of any kind.

[1] Motiograph projectors are now factory-equipped with Strong 'Zipper' changeovers.

INCANDESCENT LAMPS

(*Continued from page 20*)

nitrogen, which allows of the sections of the spiral being placed closer together without risk of breakdown. It must be kept in mind, however, that even without that danger a certain distance would have to be maintained between the spiral sections in order to avoid any chance of short circuit between the sections due to possible deformations from mechanical vibrations, heat expansion or re-crystallization.

It should be mentioned here, that it has only become possible due to the progress in the manufacture of tungsten during the last ten years to diminish the deformations due to re-crystallization upon aging of the lamp to such an extent that it became possible to construct two-plane filaments. In the case of single-plane filaments also, it is of course desirable that the spiral sections shall remain straight during the life of the lamp. But the requirement is not so forcible in this case, since only upon

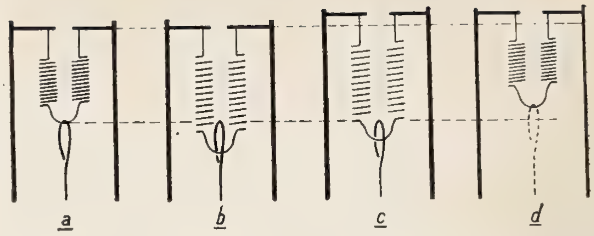


FIGURE 8. The expansion and contraction of a two-section filament and the leads upon switching on and off, *(a)* Cold state; *(b)* immediately after switching on: spiral hot, leads still cold; *(c)* in operation; *(d)* directly after switching off: spiral cold leads still hot.

deformation of the spirals in one direction is there chance of short circuit; while with two-plane filaments deformation in almost every direction may result in short circuit.

Accurate Filament Positioning

In order to satisfy the aforementioned requirement that upon inserting the lamp in the projector the filament will automatically be situated at the correct spot, each lamp is provided with an inner socket and an outer socket, the latter of which can only be placed in the lamp holder of the projector in a single definite way (so-called centering socket). In a model of the given projector the lamp with inner socket is first placed in exactly the correct position with respect to the outer socket, which is checked by projection of the incandescent filament on a small screen with indicating marks [Fig. 7].

It is essential that the adjustment described should be carried out while the lamp is burning normally, because in a cold state the filament is in general in a different position than in the hot state, due to the fact that the leads and hooks and the filament itself expand when hot. A similar method is used for the locating of the auxiliary mirror on the wall of the envelope. The adjustment of the filament with respect to the mirror takes place during the fusing in of the pinch, simply by observing the mirror image of the filament. In the cold state, filament and mirror image must be shifted mutually a certain distance in order to fit together satisfactorily when the filament is hot.

It is necessary, of course, that all parts of the filament remain sufficiently firm in place during the life of the lamp and are not deformed or warped by possible tensions in the material. How such tensions may occur is shown in Fig. 8. The spiral in two sections here shown as an example must be secured by a hook at the lower side to prevent lateral deviation. Due to the fact that the thin filament becomes hot and cold much more rapidly than the thick leads, when switched on the spiral has a slight play for several seconds; when switched off, on the other hand, the spiral (and the hook) would be under a high tension for several moments.

In order to prevent this in the case of the more complicated filaments (two-plane systems) a so-called sag arrangement is employed [compare Fig. 5]. The hooks are not rigidly fixed, but are able to move slightly up and down vertically, while still giving the spiral sections sufficient support against lateral deviations.

Thanks to these measures and to the previously mentioned absence of deformation in the spirals due to re-crystallization, all parts of the filament retain their correct positions during their whole lifetime, and no decrease in light occurs in the projector due to gradual loss of adjustment.

[To be Continued]

IN THE SPOTLIGHT

(*Continued from page 23*)

pretty hot number in those days. . . . Arbitration of wage scales in Springfield. Ohio. awarded projectionists $27 per week and 85c per hour for overtime. . . . The Executive Board reported the settlement of jurisdictional disputes between the I. A. and the building trades unions with regard to work in the moving picture studios in Los Angeles. L. A. Local 33 protested the settlement, later withdrawing the protest. . . . Local 435. El Dorado. Ark.. members were duped by one calling himself Jerry Grant, who represented himself to be a member of the local union in Michigan City. Although he failed to produce proper credentials, he obtained work through the El Dorado local and all went well (for him) until he was arrested for forgery. He was held in $300 bail, which was obligingly furnished by the members of Local 435, after which he promptly skipped town, leaving the boys holding the bag. . . . President Harding's suggestion anent the establishment of a National Industrial Court met with a cool reception from both organized labor and the large business interests. . . . The *New York Times* of December 16. 1921, carried the following statement attributed to Ben W. Hooper, vice-chairman of the Federal Railroad Labor Board and former governor of Tennessee: "Unchecked unionism in the United States will eventually lead to bolshevism and death." (Mr. Hooper evidently studied the subject at long range, and had little if any conception of what unionism really means).

● Henry Woods, secretary of Fort Worth Local 330 deserted his beloved Texas for some pheasant hunting way up in South Dakota. He could have gone over to North Dakota, but being a true Texan he prefers South Dakota. Senator Claghorn, please note.

● The I. A. office successfully negotiated a contract with the Chesapeake & Ohio Railway for I. A. men to run the picture shows on their trains. According to a statement issued by the C. & O. chairman, Robert R. Young, an order has been placed for 284 new passenger cars to replace the ones now in use. The new trains will have motion pictures, art, industrial exhibits, nursery facilities, and many other features for the comfort and entertainment of passengers.

● As a result of his conferences with the producers on the West Coast, Herman Gelber, president of New York Local 306, succeeded in negotiating new contracts for screening room projectionists calling for a 15% increase in salary. These home office preview rooms have a two-man shift, seven-hour day, four-day week, two-week vacations with pay each year, and paid holidays. The salary for each man under the new contract will be $101.83 per week. Not bad, eh?

● The rush of new business has forced Harry Abbott, the Chicago Motiograph dealer (not to be confused wth Harry Abbott of New York Local 1), to enlarge his headquarters. Harry is very popular with the boys of Chicago Local 110.

The Wenzel 'Bull Dog'

By FRED WENZEL
Wenzel Manufacturing Co., Chicago

THE Bull Dog (patent applied for) is intended primarily to eliminate key breakage on all types of shafts for winding film. It was also designed for use in lower magazines, to distribute more evenly the pull strain exerted by the heavy 2000-foot reels, which, at present, are driven by a relatively small shaft key.

The accompanying description and drawing convey the detail of this device:

AR-15-A is the main casting. The edges of this casting are chamfered to avoid cutting or scratching the projectionist's hands.

AR-15-B is the reel shaft key used only in conjunction with small reels, such as the 1000-foot exchange reel, which do not fit the studs [C]. The key seats into the slotted shaft and the reel studs are removed. Fig. 1 shows how the entire length of the key is seated into the slotted shaft to increase the driving power of the key and lessen key breakage.

AR-15-C is the reel stud (two supplied). These studs are screwed into [A] at three different pairs of threaded holes: the distances of each pair being (1) 1 7/16; (2) 1 11/16; (3) 1 15/16 from the center of the shaft. The choice of the holes depends on the reel being used. When the studs are used the key [B] is flipped back out of the slot [H], as seen in Fig. 2.

AR-15-D is the special shaft used with the Bull Dog. It is special because of the slot [H] and can be supplied for practically all types of heavy-duty hand rewinders, automatic rewinders and magazines.

AR-15-E is the set screw which holds the Bull Dog firmly to the shaft. The key helps the set screw, because it always rests in the slot [H], no matter what the position.

AR-15-F is the key holding the screw allowing the key to swing freely. When ordering the Bull Dog the model number or maker of the shaft must be given, together with its diameter.